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CONTENTS.

PAGE

ADMINISTRATIVE STATEMENT ---- xix

PART I.

INTRODUCTION ---- 2

CHAPTER I, AMADOR COUNTY.

INTRODUCTION ---- 3
  Transportation facilities ---- 3
  Geology ---- 4
  Storage of tailings ---- 4
  Production ---- 4
  Table of mineral production ---- 4
ASBESTOS ---- 5
CLAY PRODUCTS ---- 5
COAL ---- 11
COPPER ---- 12
GOLD MINES ---- 14
IRON AND MANGANESE ---- 52
LIME AND LIMESTONE ---- 52
MARBLE ---- 53
SANDSTONE ---- 53
TALC ---- 53

CHAPTER II, CALAVERAS COUNTY.

INTRODUCTION ---- 54
  Railway facilities ---- 54
  Table of mineral production ---- 54
  Mineral resources ---- 55
ASBESTOS ---- 55
CHROME ---- 55
CLAY ---- 56
COPPER ---- 56
GOLD ---- 64
  Geology of East belt ---- 64
  Mining districts ---- 64
  General geology of the Mother Lode belt ---- 65
  General geology of the West Lode ---- 66
  Gold mines—quartz ---- 66
  Gold mines—placer (drift and hydraulic) ---- 114
  Gold dredging ---- 123
IRON ---- 128
LIMESTONE ---- 128
MARBLE ---- 129
MINERAL SPRINGS ---- 130
OCHRE ---- 130
SANDSTONE ---- 130
SLATE ---- 131
SOAPSTONE AND TALC ---- 131

CHAPTER III, TUOLUMNE COUNTY.

INTRODUCTION ---- 132
  Description ---- 132
  Power plants ---- 132
  Table of mineral production ---- 132
  Railway facilities ---- 133
  Wagon roads ---- 133
  Mineral resources ---- 133
  Mining conditions ---- 133
CHROME IRON ---- 134
COPPER ---- 134
  Copper belt ---- 134
  Mines ---- 135

PAGE

Gold ---- 135
  Geology ---- 135
  Gold mines—quartz ---- 136
  Gold mines—placer ---- 166
Limestone and Lime ---- 168
Marble ---- 169

PART II.

INTRODUCTION ---- 174

Chapter I, Colusa County.

Introduction ---- 175
Aragonite (*see* Onyx Marble)
Borax ---- 175
Table of Mineral Production ---- 176
Brick Clay ---- 178
Coal ---- 178
Copper ---- 178
Chrome ---- 178
Gold and Silver ---- 179
Gypsum ---- 179
Iodine (*see* under Salt)
Limestone ---- 179
Manganese ---- 180
Mineral Paint ---- 180
Mineral Water ---- 181
Natural Gas ---- 187
Onyx Marble ---- 188
Petroleum ---- 188
Quicksilver ---- 189
Salt ---- 191
Sandstone ---- 191
Stone Industry ---- 195
Sulphur ---- 196

Chapter II, Glenn County.

Introduction ---- 197
Table of Mineral Production ---- 197
Brick Clay ---- 197
Coal ---- 197
Copper ---- 197
Chrome ---- 198
Gold ---- 198
Granite ---- 198
Manganese ---- 198
Marble ---- 198
Mineral Water ---- 198
Natural Gas ---- 199
Onyx Marble (*see* Marble)
Petroleum ---- 199
Quicksilver ---- 199
Slate ---- 199
Soapstone ---- 199
Stone Industry ---- 199

Chapter III, Lake County.

Introduction ---- 202
Table of Mineral Production ---- 203
Barytes ---- 204
Borax ---- 204
Chromite ---- 204
Clays ---- 204
Coal ---- 205
Copper ---- 205
Gold and Silver ---- 206

Page
Limestone 206
Mineral Paint 207
Mineral Water 208
Natural Gas 225
Onyx 225
Petroleum 225
Quicksilver 226
Stone Industry 240
Sulphur 240

Chapter IV, Marin County.

Introduction 241
Asphaltum and Petroleum 241
Table of Mineral Production 242
Brick and Clay 244
Chrome 248
Coal 248
Copper 248
Granite 249
Graphite 249
Jewelers' Materials 249
Manganese 249
Mineral Water 249
Natural Gas 250
Petroleum (*see* under Asphaltum)
Salt 250
Stone Industry 250

Chapter V, Napa County.

Introduction 262
Table of Mineral Production 262
Cement 262
Chromite 268
Coal 269
Copper 269
Gold and Silver 269
Infusorial Earth 271
Iron 271
Lime and Limestone 271
Magnesite 271
Manganese 276
Mineral Paint 276
Mineral Water 276
Onyx Marble 282
Paving Blocks (*see* Stone Industry)
Petroleum 282
Quicksilver 283
Sand and Gravel (*see* Stone Industry)
Sandstone (*see* Stone Industry)
Stone Industry 292
Volcanic Ash 299

Chapter VI, Solano County.

Introduction 300
Table of Mineral Production 300
Aragonite (see Onyx Marble)
Bituminous Rock (*see* Stone Industry)
Brick and Clay 300
Cement 302
Chromite 307
Coal 307
Fuller's Earth 307
Lime and Limestone 309
Marble (*see* Onyx Marble)
Mineral Water 309

Page
Onyx Marble 311
Petroleum 311
Quicksilver 311
Salt 312
Stone Industry 313

Chapter VII, Sonoma County.

Introduction 316
Table of Mineral Production 316
Abrasives (*see* under Gems)
Brick and Clay 316
Cement Blocks 318
Chrome 319
Coal 319
Copper 319
Diatomaceous Earth (*see* Infusorial Earth)
Garnets (*see* Gems)
Gems 320
Gold 321
Granite 321
Graphite 321
Infusorial Earth 322
Iron 322
Kaolin (*see* under Brick and Clay)
Limestone 323
Magnesite 324
Manganese 333
Marble 333
Mineral Paint 333
Mineral Water 334
Natural Gas 341
Onyx Marble 341
Opals (*see* Gems)
Paving Blocks (*see* Stone Industry)
Petroleum 341
Quicksilver 342
Stone Industry 351
Sulphur 366
Travertine and Onyx 366

Chapter VIII, Yolo County.

Introduction 367
Brick 367
Coal 367
Gold 367
Table of Mineral Production 368
Limestone 368
Manganese 368
Mineral Water 369
Quicksilver 369
Stone Industry 370

PART III.

INTRODUCTION 372

Chapter I, Del Norte County.

Introduction 373
  Brief Geological Description of Del Norte, Humboldt and Mendocino Counties 373
Black Sands 375
Building Materials 379
Coal 380
Chrome Iron 380
Copper 380
  Low Divide Mining District 381
  Diamond Creek District 384

PAGE
Monumental District 384
French Hill District 385
Other Districts 386
GOLD 386
Placers 386
Quartz 389
QUICKSILVER 390

CHAPTER II, HUMBOLDT COUNTY.

BLACK SANDS 391
BUILDING MATERIALS 391
QUARRIES 392
CEMENT 393
LIMESTONE 393
COPPER 394
Horse Mountain District 396
Mattole Mining District 399
COAL 399
GOLD 400
Placers 401
NATURAL GAS 408
GRAPHITE 408
IRON 408
MINERAL WATERS 408
OIL 410
OCHRE 414

CHAPTER III, MENDOCINO COUNTY.

BRICK AND TILE 415
COAL 415
COPPER 418
CHROME IRON 420
GOLD 420
MANGANESE 421
MAGNESITE 422
MINERAL SPRINGS 422
OIL 424
QUARRIES 425

PART IV.

INTRODUCTION 428

CHAPTER I, FRESNO COUNTY.

INTRODUCTION 429
Table of Mineral Production 432
ABRASIVES (*see* Volcanic Ash)
ASBESTOS 432
ASPHALT 432
BRICK AND CLAY 433
CHROMITE 435
COAL 436
COPPER 436
DIATOMACEOUS EARTH (*see* Infusorial Earth)
FELDSPAR 438
FULLER'S EARTH 439
GEM MATERIALS 439
GOLD 440
GRAPHITE 451
GYPSUM 451
INFUSORIAL EARTH 452
LIME AND LIMESTONE 452
MAGNESITE 452
MARBLE 455
MINERAL WATER 456

PAGE
NATURAL GAS 461
NICKEL 461
PETROLEUM 461
PUMICE (*see* under Volcanic Ash)
QUICKSILVER 462
STONE INDUSTRY 465
TIN 470
TUNGSTEN 470
VOLCANIC ASH 470

CHAPTER II, KERN COUNTY.

INTRODUCTION 471
Topography 471
Streams 472
Climatic Conditions 472
Transportation Facilities 474
Hydroelectric Plants 474
Table of Mineral Production 474
Mineral Resources 475
ANTIMONY 475
ASBESTOS 476
ASPHALT 476
BORAX AND POTASH 477
BRICK AND CLAY 477
CEMENT 478
COAL 479
COPPER 479
FULLER'S EARTH 480
GOLD 481
Mining Districts 482
Mines and Prospects 486
GYPSUM 515
IRON 516
LIME AND LIMESTONE 516
MACADAM 519
MAGNESITE 519
MARBLE 520
MINERAL SPRINGS 520
NATURAL GAS 521
ORNAMENTAL STONES 521
PETROLEUM 522
SANDSTONE 522
SULPHUR 522
TUNGSTEN 522
BIBLIOGRAPHY 523

CHAPTER III, KINGS COUNTY.

INTRODUCTION 525
Table of Mineral Production 526
BRICK 527
CHROMITE 527
FULLER'S EARTH 527
GYPSUM 527
MINERAL PAINT 527
NATURAL GAS 527
PETROLEUM 528
QUICKSILVER 528

CHAPTER IV, MADERA COUNTY.

INTRODUCTION 531
Geology 531
Geologic Notes—Sierra Nevada Mountains, southwest of Mono Lake 532
Resources 535
Table of Mineral Production 537
ASBESTOS 538
BRICK 538

Cobalt (*see* under Nickel)
PAGE
Copper 538
Gems 539
Gold 539
Iron 554
  The Minaret Iron Deposit 555
Lead and Silver 558
Mineral Water 559
Molybdenite 559
Nickel and Cobalt 559
Silver (*see* under Lead)
Soapstone 559
Stone Industry 559
  Granite 559
  Sand and Gravel 567
Talc (*see* Soapstone)
Tungsten 568
Volcanic Ash 568
Zinc 568

Chapter V, Mariposa County.

Introduction 569
  Power 569
  Geology 570
Asbestos 571
Barytes 571
Copper 572
Gold 575
  Lode Mines 575
  Placer Mines 600
Granite 600
Marble 601
Meerschaum 601
Phosphoretic Zincblende 602
Quicksilver 602
Rock Quarries 602
Slate 604

Chapter VI, Merced County.

Introduction 605
Asbestos 605
Clay 605
Copper 605
Gold 606
Manganese 606
Water 606

Chapter VII, San Joaquin County.

Introduction 607
Building Materials—Brick and Pottery 607
Natural Gas 610
Manganese 621
Water 623
Window Glass 625

Chapter VIII, Stanislaus County.

Introduction 627
Building Materials 627
  Red Brick 627
  Gravel 627
Gold 629
Magnesia 629
Manganese 630
Ochre 630
Quicksilver 632
Silica 633
Water 634

PART V.

PAGE
INTRODUCTION 636

Chapter I. San Diego County.

HISTORY 637
PHYSIOGRAPHY 637
GEOLOGY 638
TOPOGRAPHIC MAPS 645
MINERAL RESOURCES 646

Metals.

Gold 646
Copper 665
Silver 667
Lead 667
Zinc 668
Iron 668
Manganese 668
Molybdenum 668
Tin 668
Nickel 670
Antimony 670
Bismuth 670
Tungsten 670

Non-metallic Minerals.

Granite 671
Marble, Onyx 674
Crushed Stone and Sand 676
Lime, Cement 684
Brick Clays 685
Pottery Clays, Kaolin, Feldspar, and Quartz 686
Montmorillonite and Saponite 688
Gypsum 688
Asbestos 688
Mineral Paint, Paragonite, and Pinite 689
Gems 691
Abrasives 705
Lithia Minerals 706
Petroleum 708
Coal 713
Graphite 713
Salt 713
Phosphates 717
Water 717

Chapter II. Imperial County.

HISTORY 723
PHYSIOGRAPHY 723
GEOLOGY 723
MINERAL RESOURCES 724

Metals.

Gold 724
Copper 732
Silver 732
Lead 732
Iron and Manganese 732
Nickel 732

Non-metallic Minerals.

Marble 733
Crushed Stone and Sand 736
Lime and Cement 736
Clays 737
Gypsum 738

PAGE
Gems 740
Petroleum 740
Salt 741
Nitre 741
BIBLIOGRAPHY 743

PART VI.

INTRODUCTION 746

Chapter I. Shasta County.

Introduction 747
Water Resources 750
Timber Supply 750
Transportation Facilities 750
Table of Mineral Production 750
Mining Industries 751
Climatic Conditions 751
Mineral Resources 751
Hydroelectric Plants 752
Asbestos 752
Chrome 755
Clay Products 756
Coal 756
Copper 757
Description of Copper Belt 757
Outline of the Geology of the Copper Belt 758
Ore Deposits 759
Mines 760
Gold 773
History 774
Geology of Districts 775
Auriferous Gravel 776
Dredging 777
Mines—Quartz and Placer 777
Granite 804
Infusorial Earth 805
Iron Ore 805
Limestone 806
Macadam 807
Manganese 807
Marble 807
Mineral Springs 808
Sandstone 808
Tuff 808
Zinc 808
Bibliography 809

Chapter II. Siskiyou County.

Introduction 810
Geological and Topographical Features 811
Description of Streams 811
Table of Mineral Production 814
Electrical Power Plants 816
Chrome 816
Clay Products 816
Coal 817
Copper 817
Gold 820
Description of Mining Districts 824
Mines—Quartz 825
Mines—Placer 843
Mines—Hydraulic 844
Mines—Ground Sluicing 858
Mines—Drift 860
Dredging 864

Page
Granite 865
Iron 865
Limestone 865
Macadam 867
Marble 867
Mineral Water 868
Ornamental Stones 869
Platinum 869
Quicksilver 870
Sandstone 870
Soapstone 871
Bibliography 872

Chapter III. Trinity County.

Introduction 873
Geology 874
History 874
Mining Conditions 874
Mineral Resources 875
Electrical Power Plants 876
Asbestos 876
Chromite 877
Coal 877
Copper 878
Gold 882
    Mining Districts 882
    Mines—Quartz 884
    Placers—Hydraulic 901
    Placers—Ground Sluicing 916
    Placers—Drift 917
    Dredging 918
Granite 919
Iron 920
Limestone 920
Marble 921
Mineral Paint 921
Mineral Water 921
Ornamental Stones 922
Platinum 922
Quicksilver 923
Soapstone 924
Bibliography 925
LIST OF PUBLICATIONS OF STATE MINING BUREAU 926
INDEX 929

ILLUSTRATIONS.

	PAGE
Ione Coal and Iron Company's clay banks	5
N. Clark and Sons clay banks	6
Newman clay pit No. 4, showing clay strata and overburden	7
Newman clay pit No. 5, showing clay strata and overburden	7
Newman clay pit No. 5, showing storage shed	8
Newman clay pit No. 4, showing clay strata and overburden	8
Newman clay pit No. 4, showing storage sheds	9
Newman clay pit No. 4, showing bank of fire clay with overburden	9
Ione fire brick kilns	10
Drying yard of Ione Fire Brick Company and Newman clay pit No. 2	10
Vertical cross-section of Argonaut vein	17
Headframe of the Argonaut mine	18
Steel headframe; also showing machine shops and hoist, at Bunker Hill mine	21
Forty-stamp mill at the Bunker Hill mine	22
California Slimes concentrating and cyanide plant	23
View of Sutter Creek from the Central Eureka mine	24
The Central Eureka mine	25
Hoist and headframe at the Fremont mine	29
Headframe and mill at the Kennedy mine	32
Tailings elevators at the Kennedy mine	33
The Keystone mine and mill	35
The Original Amador mine, showing headframe and 20-stamp mill	40
Headframe at Pacific shaft; also showing timber and machine shops	42
Plymouth Consolidated Mines Company's 30-stamp mill	43
Flow sheet of Plymouth mill	44
Steel headframe and mill at the South Eureka mine	46
Headframe at the South Jackson mine	48
The Treasure mine, showing hoist and headframe	49
The Zeila mine	51
Campo Seco smelter of Penn Mining Company, showing No. 3 shaft and leaching tanks	60
Campo Seco smelter, showing crushing plant, bedding bins and roasters	60
Campo Seco smelter, showing blast furnace, reverberatory furnaces and McDougall roasting furnace plants	61
Geologic structural cross-sections of Calaveras County	67
View of steel gallows frame at Gwin mine	84
Another view of steel gallows frame at Gwin mine	85
Lightner and Angels mills at Angels Camp	89
Melones dam on the Stanislaus River, and portion of flume, capacity 5,000 miner's inches	93
Penstock and 6-foot redwood pipe line of Melones Mining Company	94
100-stamp mill of Melones Mining Company	95
Main power shaft in mill of Melones Mining Company	96
Headframe at Cross shaft, Utica Mining Company	111
Hoist and mill of Wilbur Womble mine	113
Calaveras dredge No. 1	123
Calaveras dredge No. 1, showing bow gantry and bucket-line in operation	124
Calaveras dredge No. 1, showing bucket-line, upper tumbler and tailings stacker	125
Butte dredge	126
Isabel dredge	126
Isabel dredge, showing bow gantry	127
A view of the Black Oak mine	139
The Dutch mine, showing mill and hoist	145
The Eagle-Shawmut mine, showing 100-stamp mill; also the Tarantula mine to the north	147
The Harvard mine, showing hoist and mill	150
The Columbia marble quarry	170
Another view of the Columbia marble quarry	171
Outcrop of "paint rock" at Ruby King Mineral Paint Mine	180
Hot salino-sulphur water flowing from tunnel of Elgin Quicksilver Mine	183

PAGE
"Geyser" at Jones Hot Sulphur Springs 185
Wilbur Hot Springs 186
Sandstone beds in McGilvray Quarry 192
St. Francis Hotel, San Francisco 193
In Quarry of Colusa Sandstone Company 194
Fifteen-foot bed of sandstone, McGilvray Quarry 195
Southern Pacific Company's "Ballast Loader" at Wyo Gravel Pit 200
Side view of concrete bridge under construction over Stony Creek, near Orland 201
Borax Lake from south side 205
"Bartlett" Spring, at Bartlett Springs 214
"Arsenic" and "Ems" springs at Highland Springs 219
Soda Spring and Grotto at Hough Springs 220
Hotel at Seigler Hot Springs 222
Fifty-ton Scott furnace at the Helen mine 232
Sulphur Bank Mine 235
Sulphur Bank Mine from lake side 236
Hot Springs in bottom of "Western Cut," Sulphur Bank Mine 237
Duxbury Point and Reef 243
Asphaltic residue from oil seepage near Bolinas 243
Plant and furnaces of the McNear Brick Company 245
Drying sheds, McNear Brick Company 245
Top of Hoffman brick kiln 246
Hoffman continuous brick kiln 247
Panoramic view of Daniel Contracting Company's quarry 251
Daniel Contracting Company's loading pier and barges 252
Daniel Contracting Company's pier and quarry 253
Quarry and pier of San Francisco Quarries Company 257
Barge "San Pablo" (self-dumping) of San Francisco Quarries Company 258
Barge "San Pablo" of San Francisco Quarries Company, side view 259
Quarry face, 200 feet high, of San Francisco Quarries Company 260
Clay pit of the Standard Portland Cement Company 263
Steam shovel in limestone quarry of Standard Portland Cement Company 264
Rotary driers in mill of Standard Portland Cement Company 265
Rotary kilns in mill of Standard Portland Cement Company 266
Final tube mills in mill of Standard Portland Cement Company 267
Standard Portland Cement Company, general view of plant from southeast 268
First National Bank Building, Healdsburg 273
At Napa Soda Springs 279
"The Rotunda" at Napa Soda Springs 280
Mill at Ætna Quicksilver Mine 283
Concentrators in mill at Ætna Quicksilver Mine 284
Plan of water-jet condenser for quicksilver retort at Oat Hill Mine 289
Dumps of low grade ore at Oat Hill Mine 290
"Little Trancas" bridge near Napa 293
"Big Trancas" bridge near Napa 294
St. Helena High School 295
Crusher and bins at Napa County Rock Plant near Yountville 296
Pacific Portland Cement Company, general view of mills 301
Orange-peel bucket excavator in quarry of Pacific Portland Cement Company 302
Tube mills and hoppers for crushing raw materials 303
Rotary kilns in new mill of Pacific Portland Cement Company 304
Solano County Jail at Fairfield 305
Concrete bridge at Vacaville 306
Rock-crushing plant of E. B. & A. L. Stone Company at Thomasson 313
Circular brick kilns of California Brick and Pottery Company 317
Magnesite from Kolling deposit, showing shrinkage cracks 323
Small vein of magnesite in serpentine 324
Magnesite from Kolling deposit, showing pitted surface, due to weathering 326
Upper tunnel, Cecilia Claim, Sonoma Magnesite Company 327
Map of properties of Sonoma Magnesite Company 329
Magnesite from "Red Slide" deposit, showing parallel shrinkage cracks 330
Magnesite outcrop on Alfred Claim of Sonoma Magnesite Company 331
The Geysers Canyon from across Big Sulphur Creek 339
Looking down the Geysers Canyon 340
Coutts Bros.' paving block quarry 354

PAGE
Paving Blocks. Melitta (Wymore) Stone Quarry -- 359
Plant at Petaluma Rock Quarry -- 362
Drag-line excavator of Russian River Gravel Company -- 363
Carnegie Library, Petaluma -- 365
Oro Del Norte black sands plant, showing method of hauling sands to bin -- 375
Oro Del Norte black sands plant, showing suction pipe line -- 376
Oro Del Norte black sands plant, showing revolving screen -- 376
Oro Del Norte plant, showing sand skip and track for dumping waste -- 377
Oro Del Norte plant, general view -- 378
Oro Del Norte plant, showing driftwood line -- 379
Map of Low Divide Mining District -- 381
Section of Alta California Mine -- 382
Monumental Mine Buildings -- 390
Tension curve of Humboldt Bay Cement -- 393
Croppings of Horse Mountain Copper Mine -- 394
Camp Buildings of Horse Mountain Copper Mine -- 395
Mill of Horse Mountain Copper Mine -- 396
Horse Mountain Copper Mining District Map -- 398
Briceland Estate Gas Well -- 407
Map of a portion of Humboldt County, showing oil occurrences -- 413
No. 1 power plant of Pacific Light & Power Co. at Cascada -- 429
Generators and water wheels, No. 1 power plant, Cascada -- 430
Transmission tower, 150,000 volts, Pacific Light & Power Co. -- 431
Brick elevator and conveyor, Craycroft-Herrold Brick Co. -- 433
Crude oil burners for brick kiln -- 434
Wire brick-cutting machine, Fresno Brick & Tile Co. -- 435
Two-stamp mill at Apache mine -- 440
Straub patent mill at Contact mine -- 442
Arrastra and plant at Providence mine, Temperance Flat -- 448
Sketch map of Sunnyside mine -- 450
Plant of Fresno Magnesite Co., Piedra -- 454
Coalinga Oil Field, looking north from Associated Oil Co., on section 36 -- 460
Oil loading rack, Crump Siding near Coalinga -- 460
Furnace at Pacific Quicksilver mine -- 462
Condensers at Pacific Quicksilver mine -- 463
Drawing off burned ore, Pacific Quicksilver mine -- 463
In the quarry of Academy Granite Co. -- 466
Block of stone (13,280 pounds) from Academy Granite Co. -- 466
Loading railroad cars at Kings River quarry -- 468
Gravel pit and plant of San Joaquin Rock & Gravel Co. -- 469
Kern River above Kernville, during flood period -- 473
Borel generating plant, Pacific Light & Power Co. -- 473
Canal, Pacific Light & Power Co. -- 474
Cement plant at Monolith, erected by city of Los Angeles -- 478
Cove Mining District, looking north -- 484
Amalie mine, mill and hoist -- 484
Flashlight photo, showing ore in Big Blue mine -- 488
Water wheel operating "Marathon" tube mill, Golden Group -- 495
Mill at Mojave Consolidated mine -- 504
New 100-stamp mill, Yellow Aster mine -- 514
Limestone croppings along Erskine Creek -- 517
Summit Lime Company's plant at Tehachapi -- 518
Ten-ton Scott fine-ore furnace and condensers, Kings Quicksilver Mining Co., Ltd. 529
"V" flume for transporting lumber, Madera Sugar Pine Co. -- 536
Discharging lumber from "V" flume -- 536
Section of Enterprise mine -- 542
Section of Gambetta mine -- 546
Section of Texas Flat mine -- 551
Southern end of The Minarets, looking from the west -- 555
Portal of tunnel in massive iron ore on Iron Mountain -- 557
Hearst Memorial Mining Building, University of California -- 560
University Library, University of California -- 560
Dressing a platform stone (size 21′ x 6′ x 2′) for the San Francisco City Hall, McGilvray Raymond Granite Co. -- 561

	Page
Sculptural carving, McGilvray Raymond Granite Co.	561
Sculptural detail on City Hall, San Francisco	562
Raymond Granite Company's quarry near Raymond—panoramic view	564
Upper part of quarry, Raymond Granite Co.	565
Wedging out a large block of granite (about 10'x 20'x 5')	565
Raymond Granite Company's quarry	566
Sather Campanile, University of California	567
Mariposa Commercial & Mining Co. dam and hydroelectric plant on the Merced River	570
El Portal Mining Co. barytes quarry	571
Remains of what is said to have been the first smelter in California, near Green Mountain	572
Copper dump on Indian Peak copper claims	574
Colorado gold quartz mine on Long Gulch Creek	579
Hite gold mine	584
Mountain King mine, mill and ditch line on Merced River	590
Ruins of what is said to have been the first mint in California	591
Ore bins, crushing plant and amalgamating plant of the Number 5 gold mine	592
Princeton quartz mine plant	594
Croppings of white marble on the south fork of Merced River	601
Merced Stone Company's rock quarry at Jasper Point	602
Ransome-Crummey rock crusher at Exchequer	603
Roofing slate from quarry of Pacific Slate Co.	604
Slate quarry of Pacific Slate Co.	604
Yosemite Gold Dredging & Mining Co. dredge at Snelling	606
Carnegie Brick & Pottery Co. plant at Carnegie	607
Floor construction of a brick kiln at Carnegie plant	608
Roberts Island brick plant of San Joaquin Brick Co.	609
Stockton Fire & Enamel Brick Co. plant	609
Central Natural Gas Co. well	611
Jackson No. 2 well at Jackson Baths	617
Gasometer and meter of a natural gas well in Stockton	618
Winship manganese prospect	622
Stockton Window Glass plant, Stockton	625
Craycroft brickyard at Modesto	628
Gold dredge of La Grange Gold Dredging Co.	628
Manganese croppings on the property of the California Manganese Co.	631
Voyle ochre mine at Knight's Ferry, owned by California Ochre Co.	632
Croppings of silica, owned by California Silica Co.	633
The Mesa and Mission Valley, looking northeast	643
The Mesa and Mission Valley, looking northwest	644
Head frame, Cleveland-Pacific Mine	650
Shaft house and dump, Owen's Mine	655
Section of Stonewall Mine	661
Independent Stone Co. quarry	677
Independent Stone Co. crushing plant	678
Independent Stone Co., filling storage bins	679
Sweetwater quarry	680
Sweetwater quarry, crushing and screening plant	681
Sand and gravel washing plant of Fenton-Sumption-Barnes Co.	682
Loading river sand near Foster	683
Tourmaline Queen Mountain and Pala Chief Mountain	696
Tourmaline Queen Mine	697
Pala Chief Mine and Hiriart Mountain	698
Pala Chief Dike and Mine	699
Mammoth quartz crystals, Pala Chief Mine	699
Stewart Lithia Mine	707
Western Salt Company's plant, general view	713
Western Salt Co., harvesting	714
Western Salt Co., salt washing equipment	715
Western Salt Co., salt stacker	716
Pegmatite dikes in schist, Tumco	726
Golden Cross Mill, Tumco	727
Mill of Picacho Gold Basin Mining Co.	730

	PAGE
Part of Placer field, Gold Basin	731
Outcrops of Creole marble, Coyote Mountain	734
Creole marble, bored by marine mollusks	735
Miocene tertiary clay, near Coyote Mountain	737
Miocene tertiary clay, east side Coyote Mountain	738
Gypsum outcrop, Fishcreek Mountain	739
Gypsum outcrop, Fishcreek Mountain	740
Lassen Peak, eruption of June 14, 1914, at 9:45 A. M.	748
Lassen Peak, new crater, 400 feet long, June 28, 1914	749
Stock & Stevens asbestos quarry, croppings	753
Stock & Stevens asbestos quarry, chrysotile deposit	754
Smelter, Afterthought mine	760
Mammoth smelter, bag house in center	768
Section of Gladstone mine	787
Stope map of Uncle Sam mine	801
Plan of workings, Uncle Sam mine	801
Holt & Gregg lime plant, Kennett	807
Klamath River near Happy Camp	812
Scott Bar	823
Davis hydraulic mine, Happy Camp	847
Dam of Forks of Salmon Mining Company	849
Marble Mountain, Siskiyou County	866
Island Mountain Consolidated copper mine	880
Globe mine, twenty-stamp mill	890
Globe mine, section of flume	891
Section of Headlight mine, Trinity County	893
Trinity Bonanza King mine; interior of mill	899
Trinity Bonanza King mine; automatic tram	899
Dredge of Alta Bert Dredging Company	919

ADMINISTRATIVE STATEMENT.

During the 64th and 65th fiscal years, the State Mining Bureau has endeavored to place itself in a position where the department will be of greater actual economic service to the mineral industry of this State, and to its many allied industries in general. In order to do this, it was first decided to rearrange and modernize the quarters in the Ferry Building in which the Bureau has been established for many years. A consolidation of certain of the departments was also made at the same time. It is pleasing to relate that much favorable comment has been made on these changes and their accompanying results.

The present State Mineralogist, Fletcher Hamilton, was appointed by Governor Hiram W. Johnson, January 21, 1913, and is "the successor in interest of the Board of Trustees of the State Mining Bureau and the State Mineralogist, under and by virtue of that certain act, * * *, approved March 23, 1893," under the amended Mining Bureau Act, approved June 16, 1913, and in effect August 10, 1913 (Stats. 1913, Chapter 679).

Complete general report.

The first work undertaken was a complete general report upon the mines and mineral resources of the State. As the annual mineral output of nearly one hundred million dollars is maintained by the production of over forty separate substances from fifty-six counties, it meant that field assistants would have to cover the entire area of California.

In order to accomplish this work, seven assistants qualified through technical education and practical experience were appointed. For the biennial period, reports on twenty-seven of the counties have been printed and are on sale in the form of advanced chapters. These advanced chapters are here combined in the present volume which has been designated, Report XIV of the State Mineralogist. In addition field work was completed in seven other counties, the reports for which will be printed during the succeeding biennial period.

County mineral maps.

Along with this work a complete set of county mineral maps of standard size and scale is being prepared. These maps will show the location of all known mineral properties as well as being up to date in other particulars.

Petroleum report.

Because of the great economic and commercial value of our petroleum resources, and because of the considerable dependence of California industries upon this fuel, a special report was deemed particularly advisable at this time. The infiltration of water into the oil sands presents a vital problem to the life of California's oil reserves, and this also was a prime factor in the making of the report. An especially well fortified assistant was obtained for this work who, with one other geologist, spent practically twelve months in a report which goes into every phase of the petroleum industry. This will be issued as Bulletin No. 69, "Petroleum Industry of California," accompanied by a folio of eighteen areal, structural and geological maps. During the course of this work, preliminary reports on the water conditions in the Coalinga and Midway-Sunset fields were issued and distributed as soon as investigation in those fields had been made.

Petroleum legislation.

Investigation and study of the water conditions in the oil fields having shown the necessity for legislation to force the proper protection of this resource, the State Mining Bureau is taking active part in cooperation with the associations in the different fields to present to the Forty-first Session of the Legislature a bill which is expected to solve as far as possible the difficulties.

Museum and laboratory.

The Museum of the Bureau is a very popular institution, and many thousands of visitors pass through it annually. The laboratory is of inestimable value to the industry, and as mineral identifications are made free of charge, many people, prospectors as well as engineers and scientists, take advantage of the high class of work maintained.

Library and statistical departments.

The library and reading room have been enlarged and the accommodations increased. As the library is rated the best mining library in the West, it is in use constantly. The scope of the statistical department is being broadened, and its reports now include more detailed information than formerly.

Throughout, we believe it is fair to state that the attitude of the mining public toward the State Mining Bureau has substantially improved.

Publications.

During the biennial period to June 30, 1914, there were published and distributed two annual statistical bulletins, namely: No. 65 and No. 68. These were very painstakingly compiled, and have had a wide distribution.

Bulletin 66 on the Mining Laws of California and the United States was a very popular publication, and an edition of 5,000 copies was completely exhausted in six months.

Bulletin 67, on the Minerals of California, is a very comprehensive report on the occurrence and description of every mineral species known in California, and is a work which is authoritative on this subject.

Geologic map.

One of the most important works which should be done by this department is the compilation and verification of a complete geological map of the State. It will be of scientific as well as economic value, and will be of great use in the advanced schools, colleges and universities, not only of the State of California, but of the United States. A beginning has been made on such a compilation.

Future plans.

Regarding the scope of future work of this Bureau: As a little reflection will show, with an annual production worth nearly one hundred million dollars, from over forty different mineral substances, there are many avenues in which constructive work may be applied.

Because of the economic conditions brought about through the European war, and the probability of the United States being forced to rely upon its own mineral resources, and because this country is a potential producer of almost every mineral substance used in the industrial world, the possibilities of future development can be foreseen. A brief review of the subject reveals the fact that in several instances California is the sole source of domestic supply, and with but few exceptions this State contains deposits of every mineral produced elsewhere in the United States. At the present time the conditions in the world's markets are such that the time is opportune for California to take its place in an enlarged field of use for its industrial and structural materials. We have in this State a large number of deposits of various minerals which make up this branch, and by making special effort toward the development of these materials, this Bureau can be of special service to the mineral industry.

Statistics of gold production show a falling off in some countries in the production of the precious metal. In order to maintain the proper equilibrium between the money base and our credit system, every effort should be made to augment our gold output. California, in addition to her present production, which leads all other states in the Union, has still a great latent gold resource, which, with the proper development could alone make up an appreciable part of the world's deficit in production. By a proper study of the ancient gold-bearing gravel channels and hydraulic gravel deposits the problems confronting the development and operation of these deposits can be solved.

The general report which has been made for the twenty-seven counties represented in this present volume will be pressed to completion in the other counties with all dispatch possible during the immediate future; and there is no doubt of its value to the industry, as the demand for this work has been incessant.

With the assistance of funds from the California Commission, an exhibit is to be installed by the State Mining Bureau, in the Palace of Mines at the Panama-Pacific International Exposition; and an information service to visitors maintained. Copies of our annual statistical bulletin will be distributed both there and at the Panama-California Exposition at San Diego.

Financial Statement.

Sixty-fourth Fiscal Year. July 1, 1912, to June 30, 1913.

Receipts.

Balance from sixty-third fiscal year	$20 30	
Appropriation, sixty-fourth fiscal year	20,000 00	
		$20,020 30

Disbursements.

Geological salaries	$883 33	
Bureau salaries	11,600 50	
Traveling expenses	1,673 10	
Rent	1,485 00	
Laboratory	112 84	
Library	657 13	
Museum	31 17	
Postage	411 24	
Sundries	3,165 12	
		$20,019 43
Balance of fund note expended		87
		$20,020 30

Sixty-fifth Fiscal Year. July 1, 1913, to June 30, 1914.

Receipts.

Appropriation, sixty-fifth fiscal year		$40,000 00

Disbursements.

Geological salaries	$12,060 00	
Bureau salaries	13,775 80	
Traveling expenses	6,915 63	
Rent	1,800 00	
Laboratory	112 07	
Library	494 08	
Museum	81 00	
Postage	821 35	
Sundries	3,581 20	
		$39,641 13
Balance of fund not expended		358 87
		$40,000 00

Mineral production for 1913.

The mineral production of California for the calendar year 1913 is here given to show the diversity and importance of our wealth in this regard and its commercial distribution by counties.

The following table shows the value of minerals produced in California by substances during the year 1913:

Substance	1913	Substance	1913
Asbestos	$1,175	Marble	$113,282
Barytes	3,680	Mineral paint	1,780
Bituminous rock	78,479	Mineral water	599,748
Borax	1,491,530	Natural gas	1,053,292
Brick	2,915,350	Petroleum	48,578,014
Cement	7,743,024	Platinum	17,738
Chromite	12,700	Potash	------------
Clay	261,273	Pumice	4,500
Coal	85,809	Pyrites	218,537
Copper	5,343,023	Quartz rock	7,756
Feldspar	7,850	Quicksilver	630,042
Fuller's earth	3,700	Salt	462,681
Gems	13,740	Sand, glass	14,143
Gold	20,406,958	Sandstone	27,870
Graphite	25	Silver	832,553
Gypsum	135,050	Soapstone	6,150
Infusiorial earth	35,968	Soda	24,936
Iron ore	4,485	Stone, miscellaneous	6,168,020
Lead	160,202	Tungsten ore	234,673
Lime	528,547	Zinc	64,845
Limestone	274,455		
Magnesite	77,056	Total	$98,644,639
Manganese	------------		

The following table shows the value of the mineral production of the various counties in the State for the year 1913:

County	1913	County	1913
Alameda	$844,217	Plumas	$143,698
Alpine	541	Riverside	2,071,969
Amador	3,013,180	Sacramento	2,925,706
Butte	2,533,940	San Benito	514,995
Calaveras	2,042,901	San Bernardino	2,486,100
Colusa	48,481	San Diego	315,694
Contra Costa	1,962,640	San Francisco	110,551
Del Norte	2,514	San Joaquin	165,157
El Dorado	67,723	San Luis Obispo	63,675
Fresno	8,438,810	San Mateo	215,371
Glenn	27,776	Santa Barbara	3,636,288
Humboldt	471,052	Santa Clara	311,383
Imperial	95,054	Santa Cruz	1,816,805
Inyo	1,942,309	Shasta	6,212,344
Kern	28,406,193	Sierra	1,010,976
Kings	1,335	Siskiyou	309,986
Lake	125,829	Solano	1,839,721
Lassen	2,382	Sonoma	239,037
Los Angeles	5,833,298	Stanislaus	272,249
Madera	371,867	Sutter	------------
Marin	278,453	Tehama	2,442
Mariposa	246,079	Trinity	435,142
Mendocino	9,450	Tulare	119,760
Merced	35,329	Tuolumne	1,198,383
Modoc	6,875	Ventura	924,972
Mono	184,428	Yolo	------------
Monterey	178,679	Yuba	2,507,139
Napa	1,186,353	Unapportioned	17,738
Nevada	2,950,367		
Orange	6,948,495	Total	$98,644,639
Placer	520,808		

FLETCHER HAMILTON,
State Mineralogist.

December, 1914.

PART I.

The Counties of

Amador County
Calaveras County
Tuolumne County

By W. B. TUCKER, Field Assistant

INTRODUCTION.

The Mother Lode District of California is one of the oldest, and is the most important quartz gold producing district in the state at the present time. Of this area, the three counties of Amador, Calaveras and Tuolumne, covered in the following report, form the central part. Geographically they are near the center of the state, and east of San Francisco, their western portions being in the foothills on the eastern flank of the Sacramento and San Joaquin valleys; while their eastern ends reach into the high altitudes of the Sierra Nevada Mountains. The principal mineral development has been in the western half, the main industry of the higher mountainous areas being stock raising. The western part is fairly well served with railroads.

This report represents the results of some five months' field work in the territory described, which was covered quite thoroughly. We have here endeavored to record all of the mineral resources and properties which have been the subject of commercial exploitation.

Acknowledgment is here made of the uniform courtesy of the operatives, and for the assistance rendered by others during the preparation of this report.

AMADOR COUNTY.

Field work in September, 1914.

Since the publication of the last report of the State Mining Bureau on the mineral resources of the State, there has been a general revival of interest in mining in this county, especially on the Mother Lode, where are located some of the deepest mines in the State. The following properties are under steady operation: Kennedy, Argonaut, South Eureka, Central Eureka, Keystone, Original Amador, Bunker Hill, Fremont, and Plymouth mines.

During the past year the old Empire and Pacific mine at Plymouth has been reopened by the Plymouth Consolidated Gold Mines Company, Limited, of London, England.

At this property a new mill has been constructed which is quite a departure from the present milling operations on the Mother Lode, where by means of heavy stamps, crushing through coarse screens, and regrinding with Hardinge mills the stamp duty has been increased from 5 tons to 15 tons per stamp. Then by means of classification an increased extraction is made. This new departure in milling will no doubt be the means of handling a larger tonnage of low-grade ore at a profit. Another mine of interest that has resumed operations is the Keystone, which has a reported past record of production of $17,000,000. The Treasure mine has been reopened, and after extensive development enough ore has been developed to assure that it will soon be on a producing basis. Besides the interest in gold mining, there has been an extensive development in the clay deposits in the neighborhood of Ione, and a large tonnage of this material is being shipped to the different pottery works in the State for the manufacture of terra cotta, sewer pipe, tile and pottery, while quite a tonnage of fire clay is made into fire brick by the Ione Fire Brick Company. Aside from a small amount of prospecting there is but little activity on the copper belt.

Transportation facilities.

Communication by railroad with this county is especially good, the mines being within easy communication with San Francisco, Stockton, and Sacramento by means of the Southern Pacific Railroad from Galt to Ione and then over the Amador Central Railroad to Martell, which is within 2 miles of Jackson on the south and Sutter Creek on the north. There are good auto and wagon roads from Martell and Carbondale stations to the different mines.

Geology.

There are three distinct lodes in Amador County. The principal one is the Central or Mother Lode belt, about 6 to 10 miles east of which is the East belt, occurring in the granite area near the Pioneer and Defender districts. About 8 miles west of the Mother Lode belt at Ranlett is the copper belt running in a northwesterly and southeasterly direction through the county, the ores of which occur in the form of copper sulphides associated with iron pyrites in amphibolite schist, and diabase.

The quartz veins of the Mother Lode, may be divided into three classes: those occurring only in the black clay slates of the Mariposa beds, those occurring on the contact of the black slates on the west, and diabase on the east, and those in the amphibolite schist. The Plymouth Consolidated mines are an example of the first; the Keystone, Kennedy, Argonaut, South Eureka and Central Eureka are the second; while, the Zeila and Hardenburg are of the third class. The general strike of the veins is from north and south to a northwesterly and southeasterly direction, with a dip of from 50 to 70 degrees to the east.

The veins are in the form of quartz and stringer leads, with as a rule a heavy gouge on the footwall.

Storage of tailings.

The mines along the lode have been put to a great expense in having to provide means for the storage of tailings. The Kennedy mine has installed a series of tailings elevators, for elevating the tailings from the mill to a storage reservoir, where they are impounded by a concrete dam 540 feet long and 50 feet high. All the other mines are buying land and building storage dams to take care of their tailings.

Production.

The reported records of production of the following mines on the Mother Lode in Amador County are:

Kennedy	$10,000,000
Argonaut	4,000,000
Oneida	2,500,000
South Eureka	2,000,000
Central Eureka	2,000,000
Old Eureka	20,000,000
Wildman & Mahoney	3,500,000
Lincoln	2,000,000
South Spring Hill	2,000,000
Keystone	17,000,000
Bunker Hill	3,000,000
Fremont	5,500,000
Plymouth	12,000,000

Amador County's mineral resources consist of asbestos, brick, chrome, clay, coal, copper, gold, lime, sandstone, silver, soapstone.

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AMADOR COUNTY—Table of Mineral Production.

Year	Gold	Silver	Coal		Copper		Clay		Lime		Limestone		Marble		Stone industry		Miscellaneous and unapportioned	
	Value	Value	Tons	Value	Pounds	Value	Tons	Value	Barrels	Value	Tons	Value	Cubic feet	Value	Kind	Value	Kind	Value
1880	$1,495,053	$1,953															Unapportioned, 1900–1909	$318,422
1881	1,450,000	1,500																
1882	1,500,000																	
1883	1,590,000																	
1884	2,000,000	2,000																
1885	2,145,591	3,700																
1886	1,874,062	6,136																
1887	1,979,956	2,069																
1888	1,750,000	3,500																
1889	1,560,975	6,398																
1890	1,459,952	9,357																
1891	1,395,952	13,895																
1892	1,210,383	8,008																
1893	1,505,973	5,230																
1894	1,331,916	280	15,280	$23,020			2,500	$3,000					25,941	$35,826				
1895	1,391,929	1,089	21,323	31,985	16,500	$1,650	9,960	10,285					4,864	6,566				
1896	1,523,351	3,767	19,775	29,662	30,000	3,000	8,413	27,825					4,389	5,415				
1897	1,324,472	3,477	20,000	25,000			3,492	9,540					3,864	6,280				
1898	1,806,363	1,742	18,500	29,550	3,000	300	7,197	8,297					2,850	3,594				
1899	1,544,868	6,902	18,500	23,125			10,700	10,900					4,582	7,925				
1900	1,373,788	14,915	27,477	41,215	220,000	34,100	11,500	9,100					4,103	5,891				
1901	1,823,827	7,444	25,000	30,000	52,000	8,190	10,050	7,100					2,945	4,630	Brick	$7,000		
1902	1,629,151	2,686	5,450	10,912	130,000	14,620	12,723	13,728					6,300	8,016				
1903	1,609,744	4,336			10,000	900	22,000	19,460					3,074	5,379				
1904	2,000,574	4,055			14,000	1,400	20,608	10,770	1,700	$1,700			4,785	6,558			Sand, glass	750
1905	2,445,815	17,930			10,000	1,560	21,775	20,000	1,000	1,500			2,703	3,950				
1906	2,260,373	14,579			8,648	1,669	26,789	28,119	1,000	1,200								
1907	2,116,182	13,515			5,300	1,020	12,465	13,992			1,000	$1,200						
1908	1,876,175	13,239			53,940	3,440	23,322	25,369	800	960	1,000	1,375			Brick	61,600	Asbestos	1,000
1909	2,298,785	16,701			288,472	36,641	33,563	32,724	1,200	1,440					Brick	28,572	Asbestos Chrome	200 332
1910	2,646,246	20,916			151,484	14,383	39,446	49,339	1,400	1,680	1,000	1,500			Brick Sandstone Soapstone	30,000 5,600 6,000		
1911	2,832,395	28,899			227,848	28,481	43,352	37,359	1,200	1,500					Brick Sandstone	20,000 45,000		
1912	2,796,194	32,037			176,608	28,975	35,100	36,856	800	1,040					Sandstone Soapstone	3,000 2,100	Quartz Sand, glass	3,556 670
1913	2,901,898	18,097			19,023	2,949	39,678	38,653	1,000	1,200					Brick Sandstone Soapstone	30,000 2,500 2,420	Other minerals	11,237
Totals	$62,511,953	$290,352	171,305	$244,469	1,416,823	$183,281	394,633	$412,416	10,100	$12,220	3,000	$4,075	70,400	$100,030		$243,792		$336,167

Total mineral production of Amador County from 1880 to 1913, inclusive:

Clay	$412,416
Coal	244,469
Copper	183,281
Gold	62,511,953
Lime	12,220
Limestone	4,075
Marble	100,030
Stone industry	243,792
Silver	290,352
Miscellaneous and unapportioned	336,167
Total	$64,338,755

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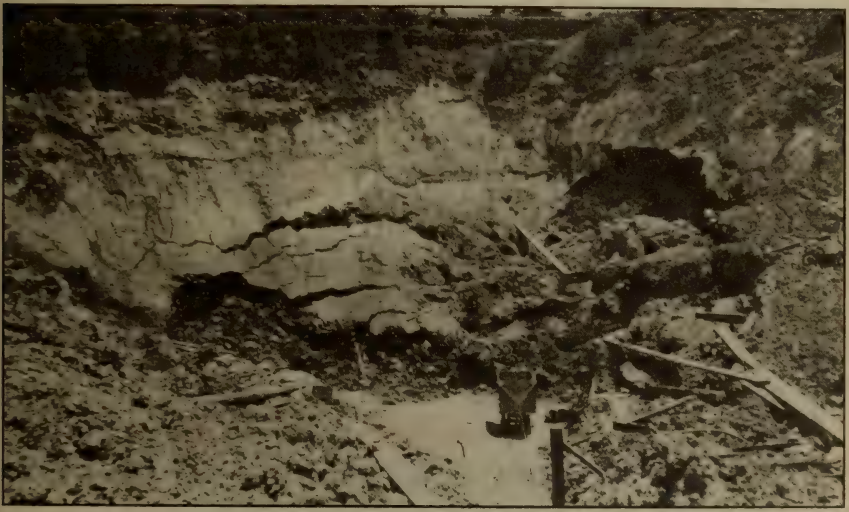
ASBESTOS.

Mace Asbestos Mine. It is 2½ miles east of Ione, on Sutter Creek; some veins and stringers of the chrysotile asbestos occur in a dark green serpentine along the contact with the black slates. Several small open cuts have been made on this asbestos. Mrs. A. Mace, of Ione, owner.

CLAY PRODUCTS.

Description of Carbondale and Ione Area. In the area about Carbondale and Ione are extensive deposits of high-grade clays. Fine plastic potter's clay and fire clays occur in unlimited quantities. There is also a highly sandy clay, and associated with these are plastic variegated clays adapted to terra cotta, sewer pipe and drain tile, and similar uses. A large part of the extensive clay area around Carbondale occurs in an old Spanish grant of 34,000 acres, which is now controlled by the Pacific Improvement Company, from whom the clay lands are leased.



Ione Coal and Iron Company's clay banks, Ione, Amador County, California.

N. Clark & Sons, 116 Natoma street, San Francisco, obtain clay for their factory in Alameda from a large pit on the Ione-Sacramento road, 2½ miles north of Ione; M. R. Bacon is their superintendent at Ione. The clay is soft, smooth, plastic, and free from grit. It has a light blue color in the interior of the bed, but changes to a snow white when dried. It occurs in a massive bed, from 20 to 30 feet thick, and is overlaid by from 3 to 10 feet of variegated, yellowish, red and white sandy clay that is stripped off and thrown to waste. The white clay is quarried in large quantities at very little expense. From the pit it is hauled by wagons to storage sheds on the railway siding. Fifteen men employed.

A. V. Clark Clay Banks. Situated 2 miles north of Cardondale, where a fire sand is obtained, which is a white clay of the Ione formation containing a large percentage of silica. A bank of white clay 20 feet thick, with 3 feet of overburden has been developed. A large amount is being quarried and hauled to Carbondale, where stored in sheds on the railroad. This product is used for making terra cotta and white brick. Five men are employed. N. Clark & Sons, 116 Natoma street, San Francisco, Cal., owners. M. R. Bacon, of Ione, superintendent.

N. Clark & Sons clay banks, Ione, Amador County, California.

Garden City Pottery Clay Banks. These banks are located 2 miles north of Carbondale. This pit furnishes a soft, plastic, refractory clay, free from grit, having a light blue color when first dug which changes to white when dried. It occurs in a bed 6 to 14 feet thick, overlain by from 1 to 6 feet of yellow, sandy clay. Clay is hauled by wagon to storage shed at Carbondale Station. Garden City Pottery Company, 560 North Sixth street, San Jose, Cal., owner. J. Newman, of Ione, superintendent.

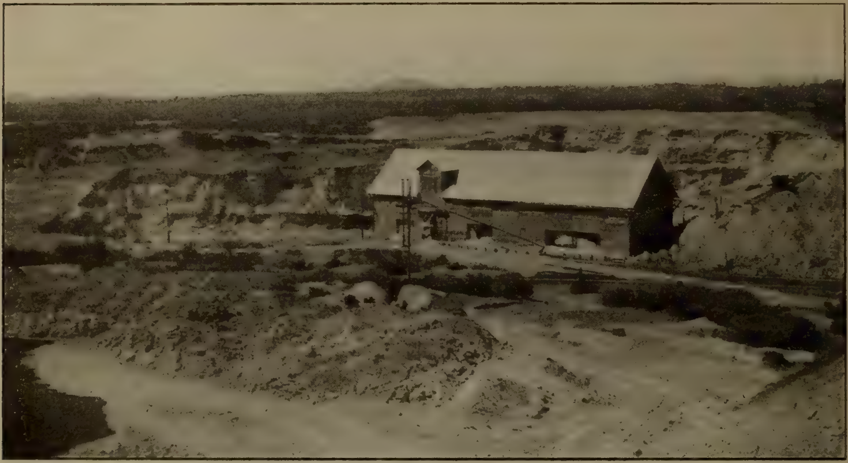
Ione Coal and Iron Company Clay Banks. This company has developed a number of high grade clay deposits on the holdings of the Pacific Improvement Company, some of which are operated by leasing companies, while the Ione company is only operating two clay pits, one near Ione adjoining the Newman clay banks, the other at mine No. 5. This latter shows a bed of clay 20 to 40 feet thick. The clay is soft, smooth and plastic, free from grit. The clay is hoisted in cars from pit over an incline, direct to storage shed. Six men are employed. A. J. Wood, superintendent.

Newman Clay Banks. Five clay banks have been opened up on the property of the Newman Clay Company, which is situated 1 mile north of Ione. No. 1 pit shows a bed of clay 8 feet thick, with an overburden of 2 to 8 feet thick. At No. 2 pit a bank of clay has been opened up 8 feet thick, overlain by 12 feet of clay, sand and gravel. On No. 3 pit only a small amount of work has been done. No. 4 pit is situated west of Amador Central Railway tracks. The clay is white, containing a large percentage of silica. It occurs in a

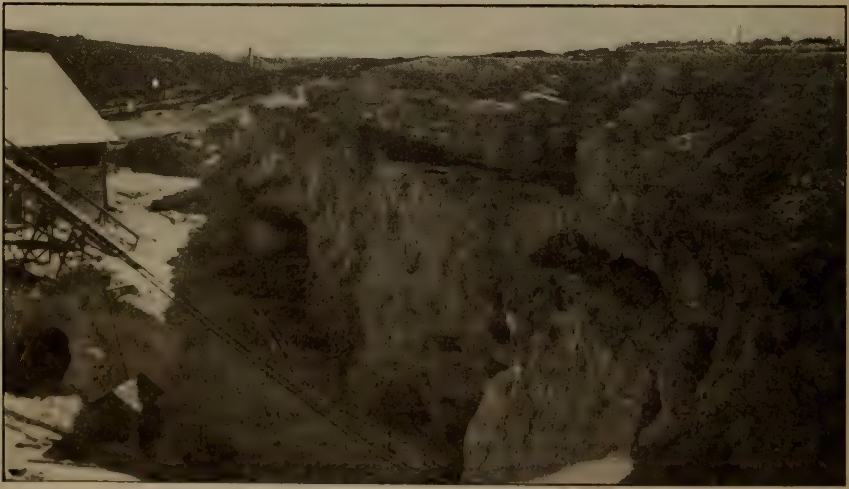
Newman clay pit No. 4, showing clay strata and overburden. Newman Clay Company, Ione, Amador County, California. Photo. by Walter W. Bradley.

Newman clay pit No. 5, showing clay strata and overburden. Newman Clay Company, Ione, Amador County, California.

massive bed, from 20 to 45 feet thick, overlain by 15 feet of overburden. In working this bank, the overburden is first stripped off. Then the bank is quarried, the clay being hoisted from pits in cars over an incline, to storage shed. No. 5 clay bank lies east of No. 4 bank, on the opposite side of the railroad tracks. At this bank a bed of clay has been developed 500 feet in length, which is 20 feet thick, overlain with 4 to 12 feet of overburden. Nos. 1, 2 and 5 are under lease to the Ione Fire Brick Company; Newman Clay Company, Ione, Cal., owners; Jacob Newman, manager; Frank B. Hand, superintendent.



Newman clay pit No. 5, showing storage shed. Newman Clay Company, Ione, Amador County, California.



Newman clay pit No. 4, showing clay strata and overburden. Newman Clay Company, Ione, Amador County, California.

Product Development Company Clay Banks. Situated ½ mile west of Ione. The clay is white, containing a large percentage of silica. It occurs as a bed, from 18 to 20 feet thick, overlain by an overburden of gravel, sand and soil, from 2 to 6 feet thick. Worked from an open pit, and by a system of underground drifts. The clay from this pit is being treated by a washing process, to eliminate the silica. Material from the pit is raised in a bucket elevator to an agitating tank, where it is agitated with water. From this tank the pulp is allowed to flow over a dam to precipitate the silica, the material in solution flows to a collecting sump, where it is pumped back to washing plant, from which plant it flows in sluice boxes to six

Newman clay pit No. 4, showing storage sheds. Newman Clay Company, Ione, Amador County, California.

Clay pit No. 4, showing bank of fire clay with overburden. Newman Clay Company, Ione, Amador County, California.

10,000-gallon storage tanks, a distance of 375 feet. From storage tanks the material in solution is pumped by 4″ by 6″ Fairbanks-Morse force pump through two forty-leaf sugar-type presses. Leaves are 33″ by 33″, with No. 10 duck canvas, on which, after three-hour treatment, a cake of clay one inch thick is formed. This cake is dried in the drying yard during the summer months or on a hot pan drier during the winter. After the cake is thoroughly dry, it is passed through a disc pulverizer, ground to flour size and sacked for shipment. Silica product is sold to glass factories. Daily production of plant, 15 tons. Twelve men employed. Product Development Company, owner, No. 58 Sutter street, San Francisco. Leo Schlyter, superintendent.

Ione fire brick kilns. Ione Fire Brick Company, Ione, Amador County, California.

Drying yard of Ione Fire Brick Company and Newman clay pit No. 2, Ione, Amador County, California.

Steiger Terra Cotta and Pottery Works. At South San Francisco, office 45 Mills Building, San Francisco, obtain clay from four pits near Carbondale: Free, Irish Hill, Baker Hill, and Gage clay banks.

This company has a lease on a zone 3 miles square, from the Ione Coal and Iron Company. The Free and Irish Hill banks produce a plastic clay, while Baker Hill and Gage banks produce fire clay. Clay is hauled to storage sheds on the Southern Pacific Railroad, with a storage capacity of 13,000 tons. M. J. Bacon, of Carbondale, superintendent.

Ione Fire Brick Company, of 946 Monadnock Building, San Francisco. C. Hidecker, of San Francisco, manager; A. S. Cunningham, of Ione, superintendent. Clay quarried from Newman Clay Company banks, which the above company has under lease. The plant consists of five round down-draft brick kilns, oil fired; capacity of kilns being 65,000 bricks, or 13,000 bricks to the kiln. The yearly output of fire brick from this plant is about 3,000,000. Thirty-five men are employed.

COAL.

Lignite occurs in the Ione formation in Amador County, nearly all the valley between Ione and Carbondale being underlain by a lignite stratum, as has been determined by borings and shafts. Some shafts in the hills north of Lancha Plana have encountered coal, which appears to be an extension of the Ione bed. There are only two mines in operation in the Ione coal field: Harvey and mine No. 4 of the Ione Coal and Iron Company.

Buena Vista Mine. Situated in Sec. 18 and 19, T. 5 N., R. 9 E., on the Fitzsimmons ranch, 5 miles southeast of Ione. A bed of lignite coal 11 feet thick has been developed, which is overlain by 59 feet of clay. The coal beds have a strike of north and south, and dip 7° to 10° to southwest. Two shafts have been sunk to a depth of 70 feet, and 210 feet apart. A drift has been run south from the south shaft on the coal bed a distance of 400 feet, and north 100 feet. Drifted east and west 200 feet on coal stratum. Idle. C. R. Downs, of Sutter Creek, owner.

Harvey Mine. It is ½ mile north of Carbondale. An extensive amount of systematic development has been done on this property, and a coal bed 20 feet thick, overlain by a body of clay and sand 20 feet thick, has been developed. Strike of coal bed is north and south, with a dip 8° W. Workings consist of a vertical shaft 88 feet deep, from which a crosscut has been driven 69 feet west in the coal seam, with drifts north and south totaling over 1000 feet. Four men employed. F. H. Harvey, of Galt, Cal., owner.

Ione Coal and Iron Company. See our Reports VII, pp. 41–42; VIII, p. 110; XI, p. 147.

The coal beds on this property have been developed through five shafts, only two of which are under operation at present, shafts No. 4 and No. 5. Both of these shafts are 90 feet deep; the present work is being carried on through No. 4 shaft, where a lignite stratum 7 to 15 feet thick has been developed, which is overlain by a body of clay and sand about 60 feet in thickness. The strike of these coal beds is north and south, with a dip of 5° to 7° SW. Average width of coal is 12 feet. There is a tramway 1000 feet long from No. 4 shaft to coal bunkers on the railroad. Twelve men are employed. Ione Coal and Iron Company, owner, 401–406 Crocker Building, San Francisco, Cal. A. J. Wood, superintendent.

COPPER.

General geology. The copper deposits occur in amphibolite schist, on both sides of a narrow strip of a little more than a mile in width, of Mariposa slates, traversing the county in a direction south by east to north by west from the Mokelumne to the Cosumnes River, extending north into El Dorado and south into Calaveras. On the eastern belt are located the Copper Hill, the Newton and a number of prospects. On the western belt are situated those of the Pacific Improvement Company, and various undeveloped properties. The character of the ores is essentially the same in all the deposits, chalcopyrite with pyrite forming the bulk, the richer oxides and sulphides being comparatively rare. The ores from the Newton mine on the eastern belt are distinguished by their purity, containing neither zinc nor any other injurious elements in appreciable quantities and very little gold and silver, while those of the western belt carry zinc, and greater values in gold and silver.

Allen (Hayward) Mine. It is situated north of the Newton mine, about 5 miles east of Ione. The ore occurs in lenses in amphibolite schists, which is capped with iron gossan. The ore is chalcopyrite associated with pyrite, with some zinc and marcasite. Developments consist of shaft 380 feet deep, with two levels at depths of 270 and 380 feet, with drifts north and south on the vein. Four men are employed on development work. G. E. Allen, of Sutter Creek, owner. C. M. Johnson, superintendent.

Cosumnes (Copper Hill) Mine. See our Bulletin No. 50, page 226. This property comprises 2,500 acres of patented land, owned by W. F. Detert, of Jackson, and that portion on which the old workings are located lies in Sec. 34 and 35, T. 8 N., R. 9 E. The main shaft is situated on the Cosumnes vein, running northwest and southeast, dipping 60° NE., varying in width from 2 to 4 feet. The ore is principally a fine-grained massive chalcopyrite, containing gold and silver values. The main shaft is 500 feet deep. A short distance from the main shaft is the southeast shaft, on a vein running parallel with the Cosumnes vein and about 50 feet east of it. It has a depth of 150 feet. Numerous prospect holes have been sunk on the main vein. There are over 1200 feet of shafts and over 1800 feet of drifts on this property. Idle.

The Johnson Ranch Mine. See our Bulletin 50, page 227. This property is located on Stony Creek, about 5 miles southwest of Jackson in Sec. 25, 35 and 36, T. 6 N., R. 10 E. The vein lies between the greenstone and slate, course northwest and southeast, dip to the northeast. Two shafts have been sunk on this vein to a depth of 90 and 210 feet. Idle. Frank Johnson, of Jackson, Cal., owner.

Ione Copper Mine. See our Bulletin 50, page 227. It is 3 miles northwest of Ione, near Irish Hill. Located in Sec. 11, T. 6 N., R. 9 E. The course of the vein is N. 35° W. dipping 60° NE., with an average width of 4 feet. Two shafts have been sunk on this vein; south shaft is 600 feet deep; and about 500 feet north is the other shaft, with a depth of 235 feet. Two ore shoots have been developed with lengths 35 and 110 feet. Some high-grade ore has been shipped from this property, assaying Cu 7%, Au $8.00, Ag 5 ounces, Zn 4.5%. There is a steam hoist and 3-stamp mill on the property. Three men are employed sorting over the dumps. Ione Coal and Iron Company, 401–406 Crocker Building, San Francisco, Cal., owner. D. F. McLennan, superintendent.

Newton Mine. See our Bulletin No. 50, pages 222–224. Situated 4 miles east of Ione, at Ranlett, on the stage road to Jackson and Sutter Creek. The gossan capped vein is from 4 to 8 feet wide, with a course of north and south, dip 70° E. The property was worked through two shafts, one 150 feet and the other 430 feet deep, and by 2000 feet of drifts on four levels, besides winzes and stopes. The ore is chalcopyrite associated with iron sulphides which occur in solid lenticular ore bodies. There is a steam hoist, and an 80-ton water-jacket blast furnace on the property. Last work on the property was in 1900. Idle. Mrs. E. A. Ranlett, Miss Helen Ranlett, New York City, owners.

Moon Mine. See our Bulletin No. 50, pages 224–225. It is 2½ miles east of Richey, and southerly from Newton mine. In Sec. 3, 9, 10, T. 5 N., R. 10 E. Two shafts, one 100 feet deep, the other 140 feet deep. Idle. J. B. Lucas, of Valley Springs, owner.

Thayer Mine. See our Bulletin No. 50, page 225. In Sec. 23, T. 5 N., R. 10 E., a little north of the Calaveras River. Situated 10 miles southeast of Ione. Shaft 250 feet deep. Idle. B. W. Thayer, of San Jose, Cal., owner.

For reference in regard to the following mines and prospects on the copper belt, which have been abandoned, see our

Bulletin No. 50, "The Copper Resources of California":

Bull Run Mine. See 15, T. 5 N., R. 10 E.

Chaparral Mine. Sec. 10, T. 5 N., R. 10 E.

Forest Home Mine. One half mile north of Forest Home.

Ione City Mine. Sec. 3 and 4, T. 5 N., R. 10 E.

Mineral City Mine. T. 8 N, R. 9 E.

Mutual Life Insurance Company. Twenty-seven hundred acres, 1 mile north of Forest Home.

Russell Mine. On Russell ranch, Sec. 10, T. 5 N., R. 10 E.

Whittle Mine. On Whittle ranch, 1 mile southeast of Forest Hill.

GOLD MINES.

Acme (Robinson) Mine (quartz). See our Report XIII, page 66. It is 3 miles north of Volcano, near the Oleta stage road. Shaft 300 feet deep. Caved. Idle. Acme Mining Company, owner.

A. and B. Mine (quartz). It is 1 mile south of Plymouth. Shaft 175 feet deep, sunk on vein at angle of 55°. Open cut 200 feet long by 50 feet wide. Vein distinguished by massive outcrop of quartz 50 to 100 feet in width, located on the hanging-wall of the Mother Lode. The vein has a slate footwall and a greenstone hanging-wall. Idle. Mrs. Maggie Reaves, 1316 Eighteenth street, Sacramento, Cal., owner. John C. Reaves, of Plymouth, agent.

Allison Mine (quartz). See our Report XIII, page 66. It is situated 1½ miles northwest of Plymouth. Course of vein is N. 45° W., dip 50° NE. and from 4 to 12 feet wide. Incline shaft 300 feet deep. Caved. Idle. State of California, owner.

Alma Mine (quartz). See our Reports XII, p. 70; XIII, p. 66. It is situated ¼ of a mile west of Jackson. Shaft 420 feet vertical; to a depth of 375 feet, then sunk an additional 600 feet on 60° incline. On 400-foot level a crosscut was driven 350 feet west in diabase, and there is a crosscut east 200 feet, cutting a belt of slate 140 feet wide to contact, between slate and diabase. A vein was cut in this slate belt, but contained no values. On the 1000-foot level, a crosscut was run east 20 feet to contact between slate and diabase, and drift driven 380 feet north and 463 feet south on gouge. At point 350 feet south of crosscut in south drift, a raise was put up 130 feet above the level. Shaft in good condition.

Equipment consists of 12″x14″ double drum steam hoist, 4-drill Rand compressor and two 80 h.p. boilers. Idle. Alma Mining Company, F. C. Siebe Estate, H. Paulson, secretary, 432 Battery street, San Francisco, Cal., owners. John B. Frances, of Jackson, agent.

Alpine (Wheeler) Mine (quartz). See our Report XIII, page 67. It is situated in the town of Plymouth, and north of the Plymouth Consolidated group of mines. Shaft sunk on an incline of 55° to depth of 200 feet, where a cross fissure was cut, from which point the shaft followed the cross fissure having a course of S. 26° E. to a depth of 460 feet on 55° incline. A lens of greenstone about 400 feet wide in the Mariposa slates forms the cross fissure. At a point 80 feet west of shaft, on 500-foot level, cross fissure vein intersects a north and south vein which cuts it off. Three veins have been developed: cross fissure, east and west, north and south. An extensive amount of drifting and crosscutting has been dcne on 500 and 600-foot levels, but no pay ore has been developed. Cross fissure and north and south veins have greenstone footwall and slate hanging-wall, while east and west veins have a greenstone hanging-wall and slate footwall. The equipment on the property consists of single drum hoist driven by 35 h.p. motor, and a (17″x14″)—(10″x14″) Ingersoll-Rand compressor driven by 100 h.p. motor. Idle. W. H. Hooper of Woodside, San Mateo County, Cal., owner.

Amador Gold (Ætna) and Amador Queen Mines (quartz). See our Reports VIII, p. 88; X, p. 102; XII, p. 71. Situated 2 miles south of Jackson. The deposit is a contact vein, having a Mariposa slate footwall and an amphibolite schist hanging-wall, which has a course of N. 10° W., with a dip of 65° E. On the surface it is distinguished by a massive outcrop of quartz about 50 feet in width. An incline shaft 700 feet deep was sunk on Amador Gold. Amador Queen shaft is 1250 feet deep, sunk on 65° incline. An extensive amount of drifting has been done on both properties, but ore developed was very low grade. Equipment consists of compressor and double drum electric hoist. Idle. W. J. McGee, of Jackson, Cal., owner.

Amador King (Rhetta) Mine (quartz). Situated 3 miles north of Plymouth, on Indian Creek. There are three parallel veins on property, which have a course of N. 10° W., with a dip of 60° to 80° E. The footwall vein has been developed by a crosscut tunnel of 400 feet, and a drift south on vein 200 feet. The vein has an average width of 4 feet, with a diabase footwall and Mariposa slate hanging. Idle. A Brown, H. A. Meyers, T. Levaggi, Plymouth, owners.

Ama Oro (Whitmore) Mine (quartz). Located ½ mile west of Volcano, on ridge north of Sutter Creek. Holdings consist of five claims: Yellow Kid, Whitmore, Stud Horse, Monday, Granite. There is a series of parallel veins on property, having a course of N. 40° E.

with a dip 55° SW. The developments consist of shaft 100 feet deep on Stud Horse vein, and a crosscut tunnel 202 feet long to west vein with a drift south on the vein 170 feet. On the Whitmore vein a tunnel has been driven 900 feet on vein, which gives 200 feet of backs. Equipment consists of compressor and 4-stamp mill. Idle. Ama Oro Mining Company, owner, 204 Westbank Building, San Francisco, Cal. A. C. Bothe, general manager; Emet Gillick, superintendent.

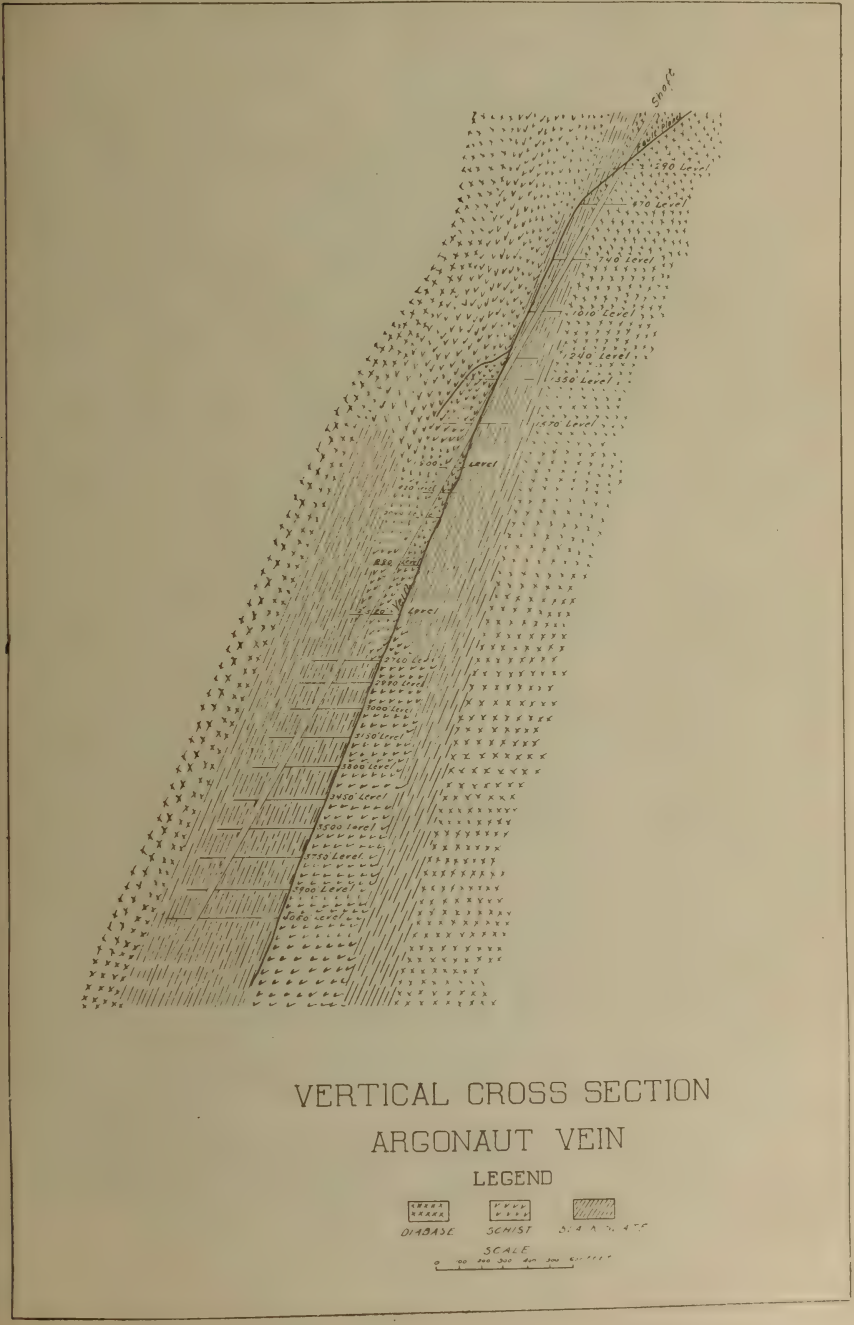
Amador Reduction Works (chlorination). See our Reports VIII, p. 96; XIII, p. 67. One half mile north of Sutter Creek. The chlorination plant, which is idle, consists of one reverberatory furnace, and a series of leaching and precipitation vats. The tailings from the chlorination plant are being treated in a 50-ton cyanide plant, which consists of steel cylindrical mill 48′ long x 3′ diameter; six wooden vats 21′ diameter x 6′ high, having a capacity of 50 tons each. Four storage tanks, twelve zinc boxes, 18″ diameter x 24″ high. Percolation method, used in treating tailings, on which an extraction of 50% is made. Five men are employed. Tailings under lease to Pioneer Reduction Company of Nevada City, Cal., B. Hall, manager. E. C. Voorhies, of Sutter Creek, Cal., owner.

Amador Queen No. 2 Mine (quartz). Located 2 miles south of Jackson. The vein is in the form of a stringer lead in the Mariposa slates. Workings include a crosscut tunnel 1300 feet long driven through slates to diabase footwall, where a shaft was sunk on the contact to a depth of 900 feet on 62° incline. On tunnel level drifts were driven 500 feet north and 700 feet south on the contact. There is a raise from tunnel level to surface on the contact of slates and diabase, a distance of 300 feet. From shaft, drifts were driven north and south on 500-foot and 700-foot levels. Old 20-stamp mill on property. Idle. Amador Improvement Company, Dr. Bardue, president, Mission and Twenty-second streets, San Francisco, Cal., owner.

American Flat Mine (placer). It is ¾ of a mile southwest of Oleta, on American Flat channel. Course of channel is northeast and southwest. Workings consist of two incline shafts 300 feet deep, and a tunnel 900 feet in length. The width of channel from 100 to 200 feet wide, with a depth of gravel of 4 to 7 feet, lying on slate bedrock. Two men employed washing tailings from old workings. W. D. Upton, R. T. Upton, Oleta, Cal., owners.

Anita Mine (quartz). See our Report XIII, p. 68. It is ½ mile southwest of Jackson. Incline shaft sunk in black slate footwall to a depth of 750 feet on an angle of 63°. The vein has a course of N. 20° W., with a footwall of slate and greenstone hanging-wall. Idle. Anita Mining Company, 407 Montgomery street, San Francisco, Cal., owner.

Argonaut Mine (quartz). See our Reports VIII, p. 68; XII, p. 71; Bulletin 18, pp. 50–52. It is 1 mile northwest of Jackson, adjoining the Kennedy on the south. The workings consist of a three-compart-



VERTICAL CROSS SECTION
ARGONAUT VEIN

Headframe at the Argonaut Mine, Jackson, Amador County, California.

ment shaft 4250 feet deep, sunk on an angle of 60°. At the 290-foot level the shaft cuts the vein in diabase, where the vein has a dip of 40° NE. to the 470-foot level. From 470 to 4050-foot level it has a dip of 64°. On the 1240-foot level there is a split in the vein, with a branch running off into the schist hanging-wall. The shaft is in the slate hanging-wall from the 1460-foot level to its present depth of 4250 feet. The general strike of vein is N. 10° W. and is a very regular and continuous body of quartz from 8 to 12 feet in width. The vein outcrops in a metadiabase, while above the 290-foot level it passes into the Mariposa slates, and at the point where it passes into the slates it appears that the fissure was originally opened by a thrust fault with a throw of 120 feet, the hanging-wall being thrust upward over the footwall to at least that distance. The meta-andesite becomes an amphibolite schist on contact with the slates. Two ore shoots have been developed. The north shoot is 325 feet long with an average width of 10 feet, while the south shoot has a length of 600 feet, width of 10 feet. The present work is being done on 3600, 3750, 3900 and 4050-foot levels. The ore is hoisted in 4-ton skips by 500-h.p. double-drum electric hoist, and automatically dumped into storage bins in gallows frame. From bins the ore is fed to 10″ x 16″ Knight crusher, and trammed to mill in 2½-ton cars.

Mill: Forty stamps, weighing 1,000 pounds, dropping 98 drops per minute, with 7-inch drop, and crushing 5 tons per stamp through 20-mesh wire screen. From the amalgamating plates the pulp flows to 16 Frue vanners, while tailings from vanners flow to hydraulic classifiers, where the coarse sands are eliminated, overflow going to canvas plant. An extraction of 83 per cent is made by amalgamation and concentration. One hundred and forty-five men are employed at the property. Argonaut Mining Company, 404 Humboldt Bank Building, San Francisco, Cal., owner. N. S. Kelsey, superintendent.

Arroyo Seco (*Lambing*) *Mine* (placer). See our Report VI, Pt. II, p. 23; VIII, pp. 97–104. It is 3 miles north of Ione. Idle. Pacific Improvement Company, 401–406 Crocker Building, San Francisco, owner. D. F. McLennan, of Ione, agent.

Bay State Mine (quartz). See our Reports XI, p. 146; XII, p. 71. It is 4 miles north of Plymouth. Workings consist of double compartment shaft, 4½′x9′ in clear, sunk to a depth of 1000 feet on 60° incline. There are two parallel veins on property, which strike N. 15° W. On 300 and 700-foot levels crosscuts were driven west to footwall vein, with drifts north and south on vein. On 800 and 1000-foot levels crosscuts were driven east to east vein, and drifts run north and south. There is also crosscut to west vein on 1000-foot level and drifts north and south on vein. There is a double drum steam hoist and 10-stamp mill on the property. Idle. Stockton Savings Bank, Stockton, Cal., owner. Levaggi Estate Company, of Plymouth, agents.

Battle Mountain Mine (placer). It is 1 mile north of Volcano. Course of channel northeast and southwest, width of channel is 700 feet with a depth of gravel of 1 to 7 feet. Developments consist of tunnel 570 feet long. The bed rock is slate, and channel is capped with rhyolite-tuff 150 feet thick. Two men are employed. G. Logarmarsino et al., of Volcano, owners.

Belmont (*Sutter Creek*) *Mine* (quartz). See our Reports VIII, p. 73; XI, p. 143. It is 1½ miles north of town of Sutter Creek. Dismantled and idle.

Belmont Mine (quartz). It is located 5 miles southeast of Volcano. The vein has a north and south course and dips 80° W. In granodiorite formation. Shaft 145 feet deep on vein. Idle. Frank Shulberger, John McKelvey, Oakland Savings Bank Building, Oakland, Cal., owners.

Bunker Hill Mine (quartz). See our Reports VIII, p. 57; X, pp. 75–114; XII, p. 79; Bulletin 18, p. 80. It is 1½ miles north of Amador City. This property consists of three claims: Bunker Hill, Mayflower, and Nevada, 2,587 feet on the lode. From surface to 200-foot level the Bunker Hill vein occurs on contact between the metadiabase on the east and Mariposa slates on the west, the course of vein being N. 25° W., with a dip 58° E. It has an average width of 6 feet. The vein is in slate from the 200′ to 1400′ level, while from 1500′ to 2400′ level the vein has a greenstone footwall and slate hanging-wall. On the 1400′ level an orebody has been developed 40′ west of Bunker Hill vein, running parallel with the main fissure. The orebody is 860′ long with an average width of 30′, and at a point 860′ north of shaft makes into the main fissure. This orebody occurs in the form of lenses, the schist being cut by numerous stringers of quartz, the rock being highly impregnated with pyrite running as high as 4% to 5%. The gray orebody has been developed on the 1400′, 1500′, 1750′ 1950′ levels and has a general trend to the north. At points the orebody forms the footwall of the main Bunker Hill vein.

The main shaft is a two compartment shaft 5.3′x12.6′ in clear; 2587′ deep, sunk on an incline of 58°. From 1950′ to 2400′ level the shaft is sunk in the metadiabase. On 2400′ level, a crosscut has been driven 280′ to Bunker Hill vein with drift north 330′ and south 100′. Three shoots of ore have been developed on the property. The north and south shoots on Bunker Hill vein have an average length of 500′, with an average width of 6′. The shoot of gray orebody is 600′ long with an average width of 15′. The mine water is handled by a Dean Triplex pump (capacity 50 gallons per minute) driven by 20 h.p motor on 2100′ level, which lifts water to 800′ level to a Knight Triplex pump driven by 30 h.p. motor (capacity of pump 125 gallons per minute), which raises the water to 200′ level where it flows through a drain tunnel 3000′ long. Air for mining operations is furnished by (16″x14″) (10″x14″) Ingersoll-Rand compressor, driven by 100 h.p. motor. Ore is hoisted in 2½-ton skips by double-drum hoist driven by means of rope transmission from 300 h.p. motor, and automatically dumped into ore bins in the 75′ steel gallows-frame. From ore bins the ore is crushed by 10″x20″ Knight crusher, driven by 30 h.p. motor. Crushed ore goes to storage bin, from which it is trammed to mill in three-ton cars a distance of 550′.

Mill: forty stamps, 1150 pounds apiece, dropping 6½″, 96 drops per minute and crushing 5 tons per stamp through No. 4 punched screen; pulp from batteries flows over double compartment amalgamating plates to twenty-four 6-foot Frue vanners. Tailings from vanners go to Bunker Hill cyanide plant. Total number of men employed at property is 157. Bunker Hill Consolidated Mining Company, Humboldt Building, San Francisco, Cal., owner. Elisha Hampton, superintendent.

Steel headframe; also showing machine shops and hoist, at Bunker Hill Mine, Amador City, Amador County, California.

Bunker Hill Slime and Cyanide Plant. Tailings from Bunker Hill mill flow to slime plant by means of launders, from launder the pulp goes through a ¼-mesh revolving screen, then flows to five Callow cone classifiers (32-inch diameter by 3 feet high). Sands from five Callow cones go to one Callow cone (36″ diameter by 4½′ high). The sands from six Callow cones flow to another Callow cone classifier (36″ diameter by 4½′ high) sands from this classifier going to eight redwood tanks (12′ in diameter by 8′ high), overflow from six Callow cone classifiers to two Darrow rotary slime tables; concentrates saved on these tables flow to three Pachuca tanks. Waste pulp from tables goes to hydraulic classifier, where fine sands are eliminated; overflow from classifier flows to two Darrow rotary slime tables, overflow slimes from these tables go to waste, while concentrates flow to Pachuca tanks. Sands are treated in eight leaching vats, capacity of tanks being 100 tons. One hour before tank is full, 75 pounds of lime are added to the sands. Then sands are drained, from six to eight hours time of treatment, after which sands are given a preliminary wash with weak cyanide solution (about 8 tons of solution to a tank). This is followed by 0.1% solution, after which gold solution is pumped in. Finally washed with clear water, whole treatment being about eight days. The decanted solution from sand tanks flows to storage tanks, weak solution to 8′x12′ tank, and strong solution to 8′x12′ gold storage tank. Then to two 4′x8′ filter tanks and from filter tanks to zinc boxes. Concentrates are given the following treatment: The pulp is first agitated with lime in Pachuca tanks, 50 pounds of lime added to 11 tons of ore. Agitated for eight hours at a time with strong cyanide solution. Then allowed to settle and clear solution being decanted off, after which gold solution pumped in and agitated. Settled and clear solution decanted off. This treatment lasts from three to four days. The solution that is over 0.7 of a pound flows to storage tanks, from which it flows to zinc boxes, where gold is precipitated on zinc shavings. Tailings from mill run 99 cents per ton, on which a 45% extraction is made. The tailings are treated on a royalty basis. W. E. Darrow, V. R. Fitzsimmons et al., Sutter Creek, Cal., owners.

Forty-stamp mill at the Bunker Hill Mine, Amador City, Amador County, California.

Caledonia Mine (quartz). It is 7 miles northeast of Volcano. The vein has a course of N. 15° W. dip 60° E., average width 2 feet. Formation slate. Porphyry dike follows vein on hanging-wall. Developments consist of shaft 100 feet deep on vein, and a crosscut tunnel 150 feet in length. Two men employed driving crosscut tunnel. Parker Mining Company, Tracy, Cal., owner. L. Parker, manager.

California Slimes Concentrating and Cyanide Plant. A plant is under construction for treating the tailings from the Fremont mill by the California Slimes Concentrating Company, W. E. Darrow, president and manager; C. E. Richards, secretary, of Sutter Creek, Cal. Method of treatment is as follows:

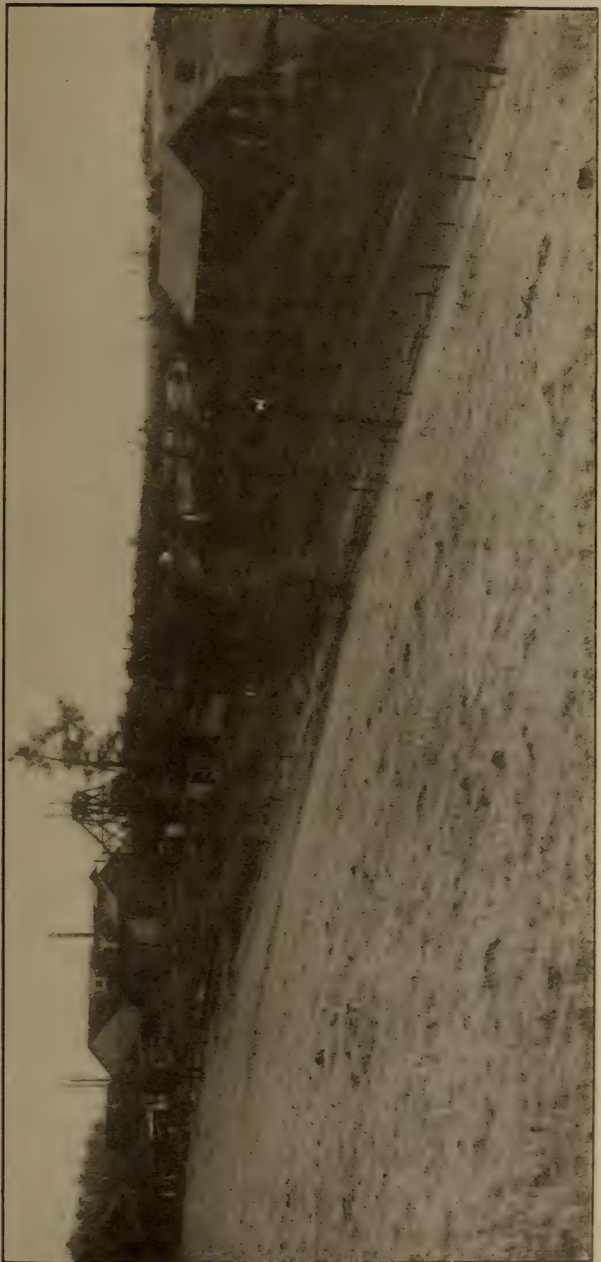
Tailings from mill flow to 60-mesh revolving screen (diameter 10 feet, made in two sections 3 feet wide). The oversize from screen goes to tailings race, while through size is elevated by tailings elevator wheel (30 feet in diameter, size of buckets being 4″x6″, spaced 3 inches apart; wheel makes five revolutions per minute), 21 feet to two Darrow rotary slime tables. Concentrates from first two tables to storage sump, where pumped to four Pachuca tanks, size 10 feet in diameter by 18 feet high, having conical bottoms with 60° cone. The overflow from tables elevated to two conical classifiers, size 42-inch diameter by 9 feet high. Underflow from classifiers to waste sluice and overflow to two Darrow rotary slime tables. Concentrates go to sump joining concentrates from other tables and pumped to four Pachuca tanks, where air agitation and decantation method used in cyanide treatment. Tailings from mill run about 60 cents per ton. Three men are employed.

California Slimes Concentrating and Cyanide Plant. Treating the tailings from the Fremont mill. Drytown, Amador County, California.

Central Eureka (*Summit*) *Mine* (quartz). See our Reports X, p. 104; XI, p. 144; XII, p. 79; XIII, p. 69; Bulletin 18, p. 18. This property joins the South Eureka on the north, ½ mile south of the town of Sutter Creek. Workings are carried on through a three compartment shaft 15′x10′ in the clear 3170 feet deep, sunk on 57° incline. Three parallel veins have been developed. Shaft cuts contact or hanging-wall vein on the 500-foot level, and is sunk on vein to 2000-foot level. From 1800-foot to 3100-foot level new shaft was sunk in footwall. On 3000-foot level shaft cuts west vein, the east vein lying 20 feet east, while contact or hanging-wall vein lies 200 feet east of the first named. The veins are in the form of stringer leads with black slate gouge on footwall. Course of veins N. 20° W., dip 55° to 70° E., with an average width of six feet. Two series of ore shoots have been developed, north series being 60 feet in length, and south shoots 200 feet long. East and west veins have slate walls, while hanging-wall vein has a slate footwall and greenstone hanging-wall. In crosscutting the slates thin lenses of metadiabase are cut. Present work is being carried on the 2800′, 3000′, 3100′ levels, where some very good grade ore has been developed upon the east and west veins. Ore is hoisted in 2-ton skips by 16″x28″ double drum steam hoist. Power is furnished by two 60 h.p. boilers, oil being used as fuel. Air for mining operations is furnished by (19″x16″, 12″x16″) Ingersoll compressor, driven by 150 h.p. motor. Ore from bins fed by gravity to 10″x16″ Blake crusher, then trammed to mill.

View of Sutter Creek from the Central Eureka Mine.

Mill: 40 stamps, of 1150 pounds apiece, dropping 100 drops per minute, crushing 4¼ tons per stamp through 24-mesh screen, pulp from amalgamation plates goes to thirty-six 6-foot Frue vanners. Mill driven by 75 h.p. motor. Only 20 stamps under operation. Central Eureka Mining Company, owner, 254 Russ Building, San Francisco; J. Davis, general manager.



The Central Eureka Mine, Sutter Creek, Amador County, California.

Clark Gravel Mine (placer). It is 2 miles south of Oleta. Course of channel is northeast and southwest. Capped with andesite flow 100 feet thick. Width of channel is from 60 to 300 feet. Depth of gravel from 4 to 7 feet and slightly cemented. Developments consist of two bedrock tunnels 800 feet in length. Two men are employed. W. D. Clark, F. M. Clark et al., Oleta, owners.

Cleveland Consolidated Placer Mine (placer). It is situated ¼ of mile northwest of Volcano. Course of channel is northwest and southeast. Capped with andesite flow 150 feet thick. Width of channel 60 to 150 feet, with a depth of gravel of 18 inches to 3 feet. The bedrock is slate. Developments consist of tunnel driven 417 feet west in slate bedrock and then northwest on channel 1100 feet. The gravel is cemented, containing large boulders of quartz and quartzite. The gravel is first allowed to slack and then treated in a Dodge disintegrating mill. Four men are employed. W. I. Smart, Victor Mathat et al., of Volcano, owners. Victor Mathat, superintendent.

Clinton Bar Mine (placer). It is 4½ miles southeast of Pine Grove in canyon of Mokelumne River. Working river bar, and drifting on old river channel. Two men employed. A. C. Adams, of Pine Grove, owner.

Clinton Consolidated (*Union Consolidated*) *Mine* (quartz). See our Reports XI, p. 142; XII, p. 72.

There are two veins on the property cutting the black slates in northeast and southwest direction and dipping 56° W. Shaft 680 feet deep sunk on Union vein, and tunnel 1000 feet long on Paugh or gouge vein cutting the shaft at the 280-foot level where the gouge and Union veins intersect. Steam hoist and 30-stamp mill on property. Idle. Chas. Wieland, of San Francisco, owner.

Columbus Gravel Mine (placer). It is 4½ miles northwest of Volcano. The channel has a northerly and southerly course and is capped by an andesite flow 100 feet thick. Width of channel is from 150 to 500 feet, depth of gravel being 2 to 8 feet. Gravel is partially cemented. Bedrock is a mica schist. Developments consist of two tunnels; north tunnel 400 feet long and south tunnel 260 feet in length. Two men are employed driving south tunnel to cut channel; this tunnel is 30 feet lower than north tunnel. G. B. Cassanelli et al., of Volcano, Cal., owner.

Comet Mine (quartz). It is 1 mile south of Amador City. Shaft 200 feet deep. Caved. Mary Mahoney Estate, of Sutter Creek, owner.

Contention (*Belding*) *Mine* (quartz). It is 2½ miles northwest of West Point, Calaveras County. Idle. Thomas Severus, of West Point, owner.

Creek Ledge Mine (quartz). It is 1 mile north of Plymouth, on Indian Creek. Shaft 100 feet deep, sunk on vein at an angle of 60°. Idle. Webb Smith et al., of Jackson, owners.

Crown Point Mine (quartz). See our Report XII, p. 92. It is 2 miles northwest of West Point, Calaveras County. Controls Tierakoff mine. Crown Point Mining Company, owner, Oakland, Cal.

Dane & Mitchell Mine (quartz). It is 1½ miles south of Volcano. Strike of vein is N. 60° E.., dip 45° E. The formation is a mica schist. Shaft 200 feet deep sunk on vein. Steam hoist (18″ x 11″ x 14″), Sullivan compressor, and 10-stamp mill on property. Idle. Dane-Mitchell Mining Company, owner, San Francisco. W. D. O'Donnell, manager.

Defender Mine (quartz). It is situated 5 miles southeast of Volcano. Shaft 360 feet deep, sunk on vein having a course of N. 15° W., dip 85° W. In granodiorite, average width of vein is 20 inches. A series of east and west diorite dikes cut the vein, having a width of 4 inches to 2 feet. At 130 feet south of shaft on 200-foot level the vein is cut by a diorite dike 22 feet wide, which has a strike of N. 50° E. with a dip 76° SE. Further development showed no ore south of this dike.

The ore is base in character, containing free gold, pyrite, chalcopyrite, marcasite, galena, sphalerite, pyrrhotite. There is a steam hoist, compressor, 10 stamp mill and 10-foot Lane mill on the property. Eight men are employed. George Joyce, F. B. Joyce, et al., owners, Defender. F. B. Joyce, superintendent.

Downs Mine (quartz). See our Report VI, Pt. II, p. 20. It is 2 miles east of Volcano. Idle and dismantled. R. C. Downs, of Sutter Creek, owner.

Doyle Mine (quartz). See our Report X, p. 107. It is 2 miles south of Jackson. Shaft 150 feet deep. Idle. William Doyle, of Jackson, owner.

Dry Creek Mine (placer). It is 5 miles north of Volcano; is worked by ground sluicing. Reale, Bell, and Hadley, of Jackson, owners. George Hadley, superintendent.

Eldorado Mine (quartz). At Amador City, on Amador Creek. Shaft on vein 300 feet deep, sunk on 45° incline. Idle. T. C. Mayou, owner, 1269 Market street, San Francisco, Cal.

Elephant and China Hill Hydraulic Mines (hydraulic). Controls the following claims: Elephant, China Hill, South Branch, Mallers, Hull and Ross, and Hodgdon Grant. Total of 645 acres. Water rights of Amador County to Tiger, Panther, Mill, and Antelope creeks; also owns Amador County Canal and McLaughlin ditches.

An extensive amount of hydraulic mining has been done on these placer holdings in past. In late years no mining operations have been carried on. Consolidated Amador and Volcano Hydraulic Gold Mining and Land Company of California, McLaughlin Estate, 354 Pine street, San Francisco, owners. Harry Lamberton, manager.

Enoch Mine (quartz). It is 2½ miles west of Volcano. Strike of vein is northeast and southwest, dipping 60° SE. Vein has an average width of 2 feet. Formation slate. Tunnel 700 feet in length driven on vein. Two men employed. E. A. Trask, of Pine Grove, owner.

Excelsior (Idaho Jr.) Mine (quartz). It is 1 mile east of Amador City. Vein has an average width of 2 feet, with slate footwall and greenstone hanging-wall. Strike N. 3° W., dip 65° E. Shaft 50 feet deep sunk on vein. Idle. Excelsior Mining Company, owner. J. R. Tregloan, agent, 1136 Merchants Exchange Building, San Francisco.

Eureka (Hayward) Mine (quartz). See our Report X, pp. 72, 102. It is situated in the southern suburbs of the town of Sutter Creek. Idle for years. Mrs. Hetty Green, of New York, owner.

Farrall Mine (quartz). It is on the Mokelumne River 4 miles south of Jackson. Idle. Lester Jacobs, of San Francisco, owner.

Fifty-four Flat Mine (placer). It is 5 miles northwest of Volcano. Idle. Fifty-four Flat Mining Company, owner. Dr. Nichols, of Sutter Creek, president.

Focus Mine (quartz). It is on Sutter Creek, 2 miles west of Volcano. Shaft 340 feet deep, sunk on vein at an angle of 60°. Ten-stamp mill on property. Idle. Knight and Company, Sutter Creek, owner.

Forty-nine Flat Mine (placer). It is 4 miles north of Volcano. Workings consist of two tunnels 1200 and 800 feet in length, with numerous lateral drifts. Channel capped with volcanic tuff 100 feet thick. Width of gravel is 100 feet with a depth of 2 to 6 feet. Bed rock is a soft mica schist. Four men employed. A. L. Reale et al., owners, 614 Sixteenth street, Sacramento.

Fremont (Gover) Mine (quartz). See our Reports VIII, p. 53; X, p. 75; XI, p. 146; XII, p. 72. Bulletin 18, pp. 80, 81. This property, 1½ miles north of Amador City, comprises Fremont, Gover, North Gover, Loyal Lode, 4200 feet on the lode. The property has been developed through two shafts, Fremont shaft being 2300 feet deep sunk on an incline of 51°, and north of Fremont shaft on the Gover claim there is an incline 1500 feet deep. The vein occurs on the contact of black slates on the west, and metadiabase on the east. The vein has a strike of N. 25° W., with a dip of 50° E., with average width of 6 feet. West of the main vein a schist ore body has been developed, which occurs in the form of lenses of various sizes. This schist ore body is in the form of quartz stringers cutting the schist, the rock being highly mineralized with pyrite. The workings on this property are very extensive, aggregating in all several miles. Steam hoist at both shafts, with oil used as fuel. Forty-stamp mill on property. One hundred forty men are employed. Fremont Consolidated Mining Company, owner, 24 Market street, San Francisco. Arthur Goodall, general manager. A. L. Palmer, superintendent.

Hoist and headframe at the Fremont Mine, Drytown, Amador County, California.

Good Hope Mine (quartz). See our Report XIII, p. 71. It is at Jackson. Shaft 125 feet deep. Idle. C. P. Vicini et al., owners, Jackson.

Grand Prize Mine (quartz). It is 4 miles southeast of Volcano. In granodiorite formation. Shaft 125 feet deep. Tunnel 200 feet in length on the vein. Idle. George Andrews, owner, New York City.

Gritton Mine (placer). It is ½ mile north of Volcano, on Clapboard Gulch. Tunnel 800 feet in length. Shaft 100 feet deep. Idle. G. A. Gritton, owner, Jackson.

Hardenburg Mine (quartz). See our Reports X, pp. 68, 106; XI, p. 139; XII, p. 74. This property, 3½ miles south of Jackson, comprises the Hardenburg, Littlefield claims, 2300 feet on the lode. The vein occurs on the contact between black slate on footwall and amphibolite schist on hanging-wall. The vein has an average width of 6 feet with wide black slate gouge on footwall, and heavy rotten hanging-wall, which make it very difficult to mine the ore. The course of vein is N. 15° W., dipping 45° E. A three-compartment vertical shaft each compartment being 4′ x 5′ in clear, has been sunk to a depth of 1070 feet. Shaft timbered with 14″ x 14″ red fir. The shaft will intersect the vein at a depth of 1500 feet. The workings consist of two levels, 850 feet and 1000 feet. On 850-foot level a crosscut has been driven west 365 feet to vein, with drifts south 308 feet and north 20 feet. At 1000-foot level the vein was cut by a crosscut 245 feet west of shaft with drifts on vein 428 feet south and 85 feet north. An ore shoot has been developed 430 feet in length with average width of 6 feet. On 850-foot level a crosscut has been driven west 250 feet to cut Littlefield vein. Ore hoisted in 1½-ton skips by double drum electric hoist driven by 450 h.p. motor. Air for drills is furnished by (16″ x 14″) (10″ x 14″) Ingersoll-Rand compressor driven by 100 h.p. motor. Ore is crushed by 10″ x 16″ Knight crusher driven by 25 h.p. motor. From ore bins at headframe the ore is trammed to the mill a distance of 300 feet.

Mill: Twenty stamps, weighing 1150 pounds each, eight 6-foot Frue vanners. The mill is driven by 75 h.p. motor. Five men employed on development work. Hardenburg Mining Company, San Francisco National Bank Building, owner. Henry Malloch, general manager. W. H. Schmal, superintendent.

Irma Mine (quartz). It is at Pioneer, 5 miles east of Volcano. The vein occurs in granodiorite, the quartz containing 10 per cent sulphurets, chiefly pyrrhotite. The shaft is 193 feet deep. Idle and dismantled. L. Cassinelli, owner, Volcano.

Isaac Newton Mine (quartz). It is 4 miles south of Jackson, on the "black metal" belt. Tunnel 300 feet long. Idle. Gustave Bowman, of New York City, owner.

Ivanhoe Mine (quartz). It is 2½ miles northeast of Plymouth. Two shafts, 100 feet and 200 feet deep. Idle. S. C. Wheeler, of Plymouth, owner.

Jose Gulch Mine (quartz). At Butte City, on Jackson and Mokelumne Hill road. Comprising the Brown, Crown, Aurora claims, 3000 feet on the lode. Workings consist of a shaft 200 feet deep, several tunnels and open cuts. There is a 10-stamp mill on property. Idle. Jose Gulch Mining Company, owner.

Kate Gray Mine (quartz). A prospect 2½ miles east of Volcano. W. Q. Mason of Pioneer, owner.

Katherine Mine (quartz). It is 5 miles east of Volcano. Comprising the Katherine and Adeline claims. Two tunnels 100 feet and 250 feet in length. Idle. Douglas Keith of Berkeley, owner.

Kelly Mine (quartz). It is at Pioneer, 5 miles east of Volcano. Shaft 90 feet deep. Idle. Frank Kelly, of Volcano, owner.

Kelly Mine (quartz). See our Report X, p. 108. It is 4 miles south of Jackson, comprising Kelly Gold, and McKay and Love claims. Tunnel 800 feet in length on vein. Caved. Idle. C. P. Vicini, owner, Jackson.

Kennedy Mine (quartz). See our Reports VIII, pp. 66–70; X, p. 103; XI, p. 141; XII, p. 74. Bulletin 18, pages 52–60. It is 1 mile north of Jackson, joining the Argonaut mine on the north. Controls the following claims: Kennedy, Kennedy Mill Site, Silva, Hall placer mine, Bellwether, Clyde, North Clyde, North Clyde placer mine, 3100 feet on the lode.

The Kennedy vein outcrops in a meta-andesite but soon passes into a narrow belt of Mariposa slates, within which the vein takes a dip of 57° to the east. It is usually strong and well defined, but it is sometimes in the form of a stringer lead. The vein follows the main eastern contact of the clay-slates with the meta-andesite, but does not conform to it at all points. The pay shoots have a trend to the north. The pay as a rule occurs near the footwall, and the vein has a heavy black gouge on the footwall from 1 to 2 feet thick, which contains some values. Three veins have been developed on the property: east, west, and footwall veins. Between the 1700-foot and 2200-foot levels there is a split in main vein, which forms the east and west veins. These veins come together on the 2800-foot level, 800 feet north of the crosscut from the main shaft. Ore shoots form north of crosscut from shaft on the west vein and south of the crosscut on east vein. The method of developing these two veins is as follows: A system of crosscuts is run from drifts north on west vein to cut east vein, while from drifts south on east vein, crosscuts are run at intervals to develop west vein. There are three shafts on the property: South shaft 2300 feet deep on the incline, being vertical for 376 feet, from which point it is on 60° incline. North shaft sunk on an incline to a depth of 2500 feet. The east shaft, the main working shaft, of 3 compartments, 6′ x 20′ in clear, has been sunk to a vertical depth of 3900 feet, in the diabase 1950 feet east of vein. This shaft cuts east vein at a depth of 3680 feet, and will cut footwall vein at a depth of 4000 feet.

Present stoping operations are being carried on from 2700-foot to 3600-foot level. On 3300-foot level they have crosscut 210 feet west to east vein, and 380 feet to west vein, with drifts 840 feet south on east vein and 75 feet north. On the west vein a drift has been driven 600 feet north, developing an average of 6 feet of quartz with 2 feet of gouge on the footwall. On this level west vein has diabase footwall with slate hanging-wall. At 3450-foot level there is a drift north from crosscut on west vein 600 feet, with drift south on east vein a distance of 600 feet. On 3600-foot level, drift north from crosscut on west vein 600 feet, and south 500 feet on east vein; developing a vein having an average width of 12 feet. At 3600-foot level the east vein has greenstone footwall and slate hanging-wall. A large amount of timbering is used in this mine due mainly to the heavy swelling ground, necessitating

Headframe and mill at the Kennedy Mine, Jackson, Amador County, California.

the use of large timbers and filling with waste within one set of the roof. Most of the filling is derived from crosscuts driven for prospecting the east and west veins. Mining operations are carried on with air drills. Air is furnished by two compressors (15″ x 30″) (25″ x 30″) Murry compound Corliss compressor, capacity of 1200 cubic feet of air, and an 800-cubic foot Fulton Engineering Company compressor. Nine 80 h.p. boilers, oil fired, furnish steam for hoist and compressors. Ore is hoisted in 4-ton skips by 800 h.p. double drum hoist, capacity of 4000 feet; dumped over grizzly, the fines going to storage bins, capacity 200 tons, and the coarse material to 12″ x 16″ Blake crusher. From storage bins in head frame the ore is trammed in two-ton cars to mill bins which have a capacity of 2000 tons.

Tailings elevators at the Kennedy Mine, Jackson, Amador County, California.

Mill: This mill contains 100 stamps, weight 1250 pounds each. The monthly capacity is about 15,000 tons. The stamps drop 7½ inches, 96 times per minute. The height of discharge is from 8 to 10 inches, three different chuck-blocks being employed to keep this as nearly uniform as possible. The grade of the plates is 1½″ per 12″, 24-mesh brass wire screen is used in the battery. There are forty 6-foot Frue vanners in use. The mill is driven by two General Electric motors, 150 h.p. and 100 h.p., by means of a rope drive. Concentrates from Frue vanners are reconcentrated on two 6-foot Gates concentrators. Tailings from mill to hydraulic classifiers or spitz-kasten, where the coarse sands are eliminated. The overflow to slimes plant where the slimes are distributed to sixty canvas tables, size 10′ x 12′. The washings from the canvas tables to two bumping circular tables and one Gates concentrator. The overflow from these goes to eight additional canvas tables. Waste overflow joins sands from classifiers and flows by means of a launder 990 feet long, with grade 2½ feet per 100′ to first tailings elevator. The diameter of tailings wheel is 68 feet, with 176 buckets per elevator (buckets, 18″ x 8″) having lift of 48 feet to each elevator. These elevators handle 500 tons of pulp with a consistency of 7 to 1. Sixty inches of water are used in excess of the slimes. The slimes from launder flow to first elevator, which elevates pulp to second launder that carries pulp a distance of 75 feet to second elevator wheel, where the pulp is elevated to a launder 800 feet long, thence to third elevator wheel which raises it to launder 160 feet long that conveys the tailings to fourth elevator, where the pulp is raised to a flume 1000 feet in length, and flows to storage reservoir. Here the tailings are impounded by a concrete dam 540 feet in length and 50 feet high. Each tailings wheel is driven by a 15 h.p. General Electric motor.

An extraction of 83% is made by the mill. Tailings run about 60¢ to 80¢ per ton. Concentrates saved by the vanners have an assay value of $100 per ton, while slimes from canvas plant run about $50 per ton. The concentrates are treated at the mine by 10-ton chlorination plant, which consists of two roasting furnaces 85′ x 12′. Two hundred men are employed. Kennedy Mining and Milling Company, owner, 409 Montgomery street, San Francisco. Webb Smith, superintendent.

Kennedy Extension Mine (quartz). It is 1 mile northwest of Jackson, joining the Kennedy mine on the south. Comprising the Jackson, Muldoon, Muldoon Mill site, and Jackson placer mine, with 1419 feet on the lode. Strike of vein is N. 20° W., dipping 66° E. The footwall is a Mariposa slate, and the hanging-wall is diabase. A 2-compartment shaft (4′ x 5′ in clear) has been sunk to a depth of 1000′ on 66° incline. Four men are employed in development work. Kennedy Extension Gold Mining Company, owner. A. C. Perry, superintendent.

Keystone Mine (quartz). See our Reports VI, Pt. II, p. 16; VIII, p. 63; XI, p. 145; XII, p. 77. It is situated at Amador City. Comprises the Niagara, East Keystone, Spring Hill and Geneva, Keystone.

Keystone Tract, and South Keystone, 4400 feet on the lode. The Keystone vein occurs on the contact between the black clay slates and meta-andesite, the former being the footwall and the latter the hanging-wall. It is a massive vein of white quartz from 12′ to 200′ wide. Two other veins have been developed, as the Spring Hill and east veins.

The Keystone Mine and Mill, Amador City, Amador County, California.

Above the 900-foot level the ore was mined from the contact vein; also a series of parallel stringer leads in the footwall slates was mined, producing from the 900-foot level to the surface about $17,000,000. These stringer leads dipped eastward into the main contact vein at angles of about 47°. The ore body was of a lenticular form, the middle portion of which lenses being occupied by a large and solid quartz vein. On the 900-foot level this ore body was 600 feet long pinching out 200 feet north of shaft and 400 feet south of shaft. There are two shafts on the property: Patton shaft is 2680′ deep, sunk on an angle of 52°, three compartments, 6′ x 20′ in clear, and south shaft 1118′ deep on 60° incline. The former is the main working shaft. From the 1400-foot level, shaft was sunk to 2600-foot level in hard diabase. On this level a crosscut was driven through diabase 690′ west of contact vein, with a drift north on vein 350′ and south 450′, on which no ore was developed. Then the crosscut was continued west 500′ cutting a body of slate 380′ wide. At a point 400′ south in south drift a crosscut was driven in the slate 275′, but no ore was found. The ore at present being mined is from east vein in greenstone to the east of contact vein on 900-foot and 1200-foot levels, where an ore body has been developed 120′ long and 25′ in width, assaying $7.00 per ton. This vein in places is 85′ wide, and to the north flattens from 45° to 15°. On the 900-foot level there is a crosscut 150′ east to Spring Hill vein, with drift north on vein 800′ and south 300′. At 1200-foot level is a crosscut east 320′ to east vein and drift north in footwall of east vein, a distance of 430′, where it cut the vein at the old workings. Then a drift was driven 640′ north. Ore is hoisted in 2-ton skips by double drum electric hoist driven by 300 h.p. motor, 12-rope transmission drive. Air for drills furnished by (17″ x 14″) (10″ x 14″) Ingersoll-Rand compressor. The ore from mine is crushed by a 5-K Gates gyratory crusher driven by 30 h.p. motor.

Mill: Twenty stamps weighing 1050 pounds each, using 7-inch drop, 102 drops per minute, crushing 5 tons through No. 3 punched screens. Pulp from plates concentrated by twelve 6-foot Frue vanners. Mill is driven by 150 h.p. motor. An extraction of 90% is made in straight amalgamation and concentration. Tailings running 30¢ per ton. Concentrates have a value of $50 per ton. Thirty-three men are employed. Keystone Mining Company, owner, Jackson, Cal. C. R. Downs, of Sutter Creek, Cal., superintendent.

Kimball Group of Mines (quartz). Situated 5 miles east of Volcano, in the Pioneer District. Comprising Lucky Strike, De Soto, Gold Crown, Deadwood, Dead Sheep. There is a series of parallel veins in granodiorite, having average width of 18″. Strike northwest and southeast, dip 70° W. Lucky Strike shaft 115′, De Soto shaft 70′. De Soto tunnel 400′ long. Dead Sheep shaft 200′ deep. The ore contains high percentage of sulphides in the form of pyrite, galena, marcasite, pyrrhotite. Two men employed sinking Lucky Strike shaft. A. A. Kimball, Pioneer, owner.

Levaggi Mine (quartz). It is 8 miles southeast of Volcano, on the North Fork of the Mokelumne River. Claims: Sawyer, Sawyer placer mine, Eureka, and Sunny South. Vein strikes north and south dip 45° west, having average width of 3 feet. In granodiorite formation. Tunnel is driven on vein for a distance of 1450 feet; at point 450 feet from mouth of tunnel there is winze 100 feet deep sunk on a pay shoot 100 feet in length, and having an average width of 3 feet. There is a 10-stamp mill on property. Idle. Levaggi Estate Company, owner. J. Esola, of West Point, agent.

Lincoln Consolidated Mines (quartz). See our Reports VIII, p. 73; X, pp. 72, 100; XII, p. 78. Bulletin 18, pp. 72-74. For Wildman mine, see our Reports VIII, p. 75; X, p. 101; XI, p. 144; XII, p. 80; Bulletin 18, pp. 65–71. For Mahoney and South Mahoney mines, see our Reports VIII, p. 73; X, p. 72; XII, p. 78; Bulletin 18, pp. 65–71.

These properties are situated at Sutter Creek. Comprising Lincoln, Stewart, Belmont, Wildman, Mahoney, South Mahoney, Lincoln Mill Site, and Walchter ranch. Controlling 383 acres, with 4200 feet on the lode. There are four shafts on this property: Wildman, 1400 feet deep on an incline of 72°. Emerson shaft 619 feet vertical. Mahoney shaft is an incline shaft 1200 feet deep, sunk on an angle of 62°. Lincoln shaft has a depth of 2000 feet, on an incline of 63°. The Emerson shaft was sunk in diabase 1000 feet east of Wildman shaft to cut Wildman vein at a vertical depth of 2300 feet. The ore body on the Wildman claim occurs in the black Mariposa clay slates, associated with some amphibolite schist. This ore body is divided into three distinct leads, called granite boulder, main lead, and Magpie lead, the main lead being a well defined vein of solid quartz, which passes into a stringer lead. The granite boulder lead lies on the footwall or western side of main lead, between the latter and the footwall slates. It is a body of amphibolite schist which is traversed in all directions by quartz stringers impregnated with pyrite. The Magpie is a stringer lead similar in character lying on the hanging-wall side of the main vein, the impregnated country rock being a black slate. The ore in both these leads is low grade. The ore body in the Mahoney mine is a stringer lead in black clay slates with a footwall of amphibolite schist. One hundred feet north of the Mahoney shaft the lode appears to divide, the Lincoln mine being on the western branch; east branch going into the Stewart claim.

The ore body in the Lincoln mine is reported to have been cut out by a large horse of greenstone on the 400-foot level; below this level no ore was developed, although an extensive amount of drifting and crosscutting was done. The vein on the Wildman on 1400-foot level is 160 feet of solid quartz. There are two mills on this property of 40 stamps each. Idle. Lincoln Consolidated Mining Company, owner, Jackson. William J. McGee, agent.

Little Illinois Mine (quartz). Situated 1 mile northeast of Drytown. Incline shaft 147 feet deep. There is a Teddy Jaw Pulvo crusher and a 6-foot Huntington mill on the property. Eight men employed cleaning out and retimbering shaft. Little Illinois Mining Company, owner, Drytown. J. W. Buchanan, manager.

Lone Willow Group of Mines (quartz). Situated 7 miles east of Volcano, comprising the following claims: Lone Willow, Sunny South, California, Mungo Park. Lone Willow tunnel 200 feet long, Sunny South shaft 100 feet deep. Idle. Chas. Gracey of Pioneer, owner.

Lucille (New London) Mine (quartz). See our Reports VIII, p. 49; X, p. 117; XII, p. 78. At Plymouth; see Plymouth Consolidated Gold Mines.

Madroña (Harding) Mine (quartz). It is about 7 miles southeast from Volcano, and ½ mile south from Pioneer. Comprising the following claims: Madroña, Pioneer, Pioneer Extension, Rattlesnake, McQuaid, North Jewell, Bowman, Golden Gate. There is shaft on

Madroña claim 100 feet in depth. On the Pioneer claim shaft 360 feet deep. The formation is granodiorite. L. Cassinelli, of Volcano, owner.

Mahoney Mine (see Lincoln).

Mammoth Mine (quartz). See our Reports VI (Part II), p. 21; VIII, p. 93; XI, p. 67, 108; XII, p. 78. Idle. F. W. Patterson Estate, of Fresno, Cal., owner. Alexander Chalmers of Angels, agent.

Markley Mine (quartz). See U. S. Mineral Resources, West of Rocky Mountains: 1870, p. 37; 1871, p. 89; 1872, p. 44. East and west vein cutting slate formation with dip of 60° N. Property under lease to William Dicting of Volcano, California, who is sinking a new shaft. There is a 10-stamp mill on the property. Four men are employed. George Howard et al., owners, Sacramento.

McIntyre Mine (quartz). See our Report X, p. 115. It is ½ mile southwest of Amador City. Incline shaft 200 feet deep. Idle. John McIntyre et al., of Sacramento, owner.

Mechanics Mine (quartz). It is ½ mile east of Sutter Creek. Idle. P. Fagan, of Sutter Creek, owner.

Middle Bar Group of Mines (quartz). They are 4 miles south of Jackson, near Middle Bar crossing of Mokelumne River. Comprises the Wetzler, Middle Bar, Astoria, and Elephantine. Series of tunnels on the property. Idle. G. W. Brown, M. Thomas et al., owners, Jackson.

Midway Mine (quartz). It is 7 miles east of Volcano. Comprising two claims: Midway, Esmeralda. Developments consist of two tunnels on vein, 200 and 400 feet in length. Granodiorite formation. Idle. W. Q. Mason, of Pioneer, owner.

Modoc Mine (quartz). It is ¾ of a mile east of Pioneer. Idle. F. Mace, of Volcano, owner.

Monte de Oro Mine (quartz). It is 2 miles north of Plymouth. Massive outcrop of quartz formed by intersection of north and south and N. 30° E. veins. On south end of claim ore was mined from an open cut 500 feet in length. At the north end of claim vein was prospected by crosscut tunnel 785 feet long, which gives 200 feet of backs. There is a 10-stamp mill on property. Idle. Levaggi Estate Company, owner, Plymouth.

Moore Mine (quartz). See our Reports VI (Part II), p. 20; VIII, p. 84; XII, p. 78. It is a mile south of Jackson. Workings caved. Idle. F. W. Patterson Estate, owner, Fresno.

Mountain King Mine (quartz). At Pine Grove. Comprising the Mountain King, Mountain Queen, Mountain Queen Mill Site claims. Developments consist of shaft 300 feet deep, and crosscut tunnel 240 feet long. Two men employed driving east drift on tunnel level. W. B. Pitts of Pine Grove, owner.

New Albany Consolidated Mines (quartz). See our Report XII, p. 78. They are on the Mother Lode, south of Jackson, and comprise Albany, Astoria, Elephantine, Hollywood, Middle Bar and New Albany. All idle. New Albany Consolidated Gold Mining Company, owner. Martin Jones of San Francisco, agent.

New York Mine (quartz). See our Reports X, p. 123; XI, p. 140; XII, p. 78. It is 3 miles west of Jackson. Idle. G. W. Anderson Estate, owner, Stockton.

North Star Mine (quartz). See our Reports VIII, p. 71; X, p. 99; XII, p. 78. Idle. E. C. Voorhies of Sutter Creek, owner.

Oneida (quartz). See our Reports VIII, p. 79; X, p. 109; XII, p. 78; and Bulletin 18, pp. 60–63. It is 1½ miles north of Jackson joining the Kennedy on north. Workings consist of a vertical shaft 2280 feet deep sunk in the hanging-wall. The shaft cut the vein at the 1900-foot station. On 2200-foot level a winze was sunk on the vein 280 feet north of shaft to a depth of 280 feet. At 1200-foot level a crosscut was driven west 500 feet, connecting with workings of old incline shaft, which has a depth of 1350 feet. The Oneida workings are connected with the South Eureka on the 1800-foot level. The Oneida vein lies in the Mariposa slates, near the contact with the meta-andesite on the west. The ore shoots on this property have a general trend toward the north, the ore developed in lower workings is low grade. There is a 60-stamp mill on the property. Development work and pumping operations are being carried on. Eight men are employed. South Eureka Mining and Milling Company, San Francisco, owner. W. H. Schmal, superintendent.

Original Amador Mine (quartz). It is in Amador City. Comprises the original Amador, East Amador, Amador Wedge, Great Eastern, Eclipse Extension, Last Chance, with 4400 feet on the lode. A system of parallel veins has been developed on this property. The principal work has been on the main contact vein which has a Mariposa slate footwall and a diabase hanging-wall. It is in the form of a massive vein of quartz from 20 to 50 feet wide. About 20 feet west of contact vein a stringer lead in the footwall slates has been developed, which shows 6 to 8 feet of good ore. To the east of main vein there is a series of parallel veins in the diabase which have a filling slate and quartz stringers. These veins have an average width of from 12 to 20 feet. Work is carried on through an incline shaft 780 feet deep, sunk on an angle of 72° to the 200-foot level, and on a 45° incline to 700-foot level. All ore milled is being extracted from development work, and no stoping is being done. Owing to the extent of the ore body and the hard character of the walls, the shrinkage stope method is used in taking out the ore.

For drawing ore from stopes cribbed chutes 4′ x 7′ with manway 3′ x 4′ made of 4″ x 6″ lumber, and spaced 30′ apart are in use. The ore is hoisted in 1¼-ton skips by double drum hoist driven by 60 h.p. Atlas gas engine. Air for drills furnished by (16″ x 14″) (10″ x 14″) Ingersoll-Rand compressor driven by 100 h.p. motor. Sullivan stoping drills are used for drifting, stoping and raising operations, water being furnished to each drill.

Mill: 20 stamps weighing 1000 pounds dropping 6″, 110 drops per minute, crushing 4½ tons to the stamp through 20-mesh screen. The pulp from amalgamating plates flows to a 3-spigot classifier, overflow going to settling tank, the coarse sands to three Deister sand tables and the slimes from settling tank to four Deister slime tables. The middlings from concentrators go to collecting sump, joining the overflow from settling tank, from which they are pumped by 1½″ centrifugal pump to 8-foot Callow cone; the overflow goes to waste launder, through-size to 6-foot vanner. The concentrates from all the tables go to collecting sump whence they are pumped to settling bins, 3 compartments, capacity of 50 tons to the compartment. Stamps are driven by 75 h.p. motor, and concentrators by 10 h.p. motor. An extraction of 90% is made by amalgamation and concentration. Tailings assay 35¢ per ton. Concentrates have a value of $80 per ton. Total operating costs are $2.56 per ton. Thirty-two men are employed. Original Amador Consolidated Mines Company, 1225 Broadway, Oakland, owner. T. S. O'Brien, superintendent.

The Original Amador Mine, showing headframe and 20-stamp mill. Amador City, Amador County, California.

Penavita Mine (quartz). It is 12 miles east of Volcano. In granodiorite formation. Three tunnels on northwest and southeast vein 50 feet, 100 feet and 200 feet in length. Frank Berg, of Defender, owner.

Philadelphia (Richmond) Mine (quartz). See our Report XII, p. 78. It is 4 miles north of Plymouth. The vein has a course of north and south, with dip of 70° E. Tunnel 600′ long on vein. There is a 20-stamp mill on the property. Idle. J. J. Crawford Estate, owners, San Francisco.

Pigeon Mine (placer). It is 1½ miles northwest of Oleta. The course of channel is northeast and southwest, capped with andesitic tuff 100 feet thick. Width of channel is 150 feet with depth of gravel from 4 to 8 feet. Development consists of bedrock tunnel 200 feet long. The gravel is cemented. Idle. Fred Pigeon Estate, of Oleta, owner.

Pioneer Mine (quartz). See our Report XII, p. 78. It is ½ mile south of Plymouth. The vein occurs in broad belt of Mariposa slates. Shaft 550 feet deep, caved. There is a 20-stamp mill on the property. Idle. Dr. Thomas Boyson, of Plymouth, owner.

Plymouth Consolidated Gold Mines (quartz). See our Reports VI, Pt. II, p. 15; VIII, p. 42; X, p. 117; XII, p. 79. Bulletin 18, pp. 82–83. This property is at Plymouth and comprises the following claims: Southerland, Simpson and Aden, Oaks, Pacific, Indiana, Reese and Woolford, Phœnix, Plymouth, New London, Rising Star, East Phœnix, East Pacific, 4800′ on the lode. There are three parallel veins on the property, occurring in a broad belt of Mariposa slates. The general course of the veins is north and south with dip of 65° E. The Pacific shaft is 1520′ deep, vertical, the remaining distance of 520′ being sunk on 55° incline; 3 compartments 5½′ x 4′ in clear. There is a curve in the shaft starting 80′ above 1600-foot level. This curve is 155′ long with a 280-foot radius. The shaft is sunk in footwall of vein from 1600-foot to 2000-foot level. Since the reopening of this property good pay ore has been developed on the 950′, 1065′, 1140′, 1220′, 1400′, 1500′, 1600′, 1850′ and 2000-foot levels, on the Empire-Pacific vein, which has an average width of 12 feet. Crosscuts have been driven east from shaft a distance of 130′ to 165′ cutting the Empire-Pacific vein. At the 1500-foot level a hanging-wall vein was cut 27 feet east of Empire-Pacific vein. This hanging-wall vein intersects the main vein forming an ore shoot on 1600-foot level. At a distance of 1500′ north on 1140-foot level, a crosscut was driven east 175′ cutting hanging-wall vein. On the 1600-foot level south the vein has a width of 24′ with an average value of about $6 per ton. While on the north ore shoot on the

2000-foot level, the width of ore developed is 16′ with an average assay value of $17 per ton.

Plymouth Mill: The ore is hoisted from the mine in 2-ton skips to a 2-story hopper, the upper part being used for waste and the lower for ore; the capacity of ore bin is 120 tons. From the latter the ore is fed to a No. 5 Gates gyratory crusher, the discharge of which falls onto a 20-inch belt conveyor, which conveys the ore for a distance of 630 feet to top of mill. The maximum slope of conveyor is 21° 15′. The conveyor is made up in two sections with a length of 315 feet each. The individual sections are driven by 10 h.p. Fairbanks-Morse motors. The ore from conveyor discharges onto 16-inch automatic Link belt distributor which distributes the ore to 1400-ton bin. From the ore bin, the ore is fed by Challenge machines to 30 stamps, weighing 1250 pounds, which drop 98 times per minute, with 7-inch drop, order of drop being 1–3–5–2–4. Stamp duty is 15 tons per stamp per twenty-four hours through ¼-mesh screen. Only 20 stamps are being used at present, 10 being kept in reserve. The pulp from batteries goes to a distributing box and automatic sampler, from which the material is fed to two 18-inch Caldecott cones. The overflow from cones goes to two 44-inch Caldecott cones, while the overflow from the latter flows to amalgamating plates. The sands from 18-inch and 44-inch Caldecott cones flow to two 8-foot by 22-inch Hardinge mills, which make 27 r.p.m., the pebble feed being 200 pounds per day. The pulp from Hardinge mills joins overflow from cones and passes over 10 double compartment amalgamating plates 6′ x 14′ in size. The plate tailings pass through

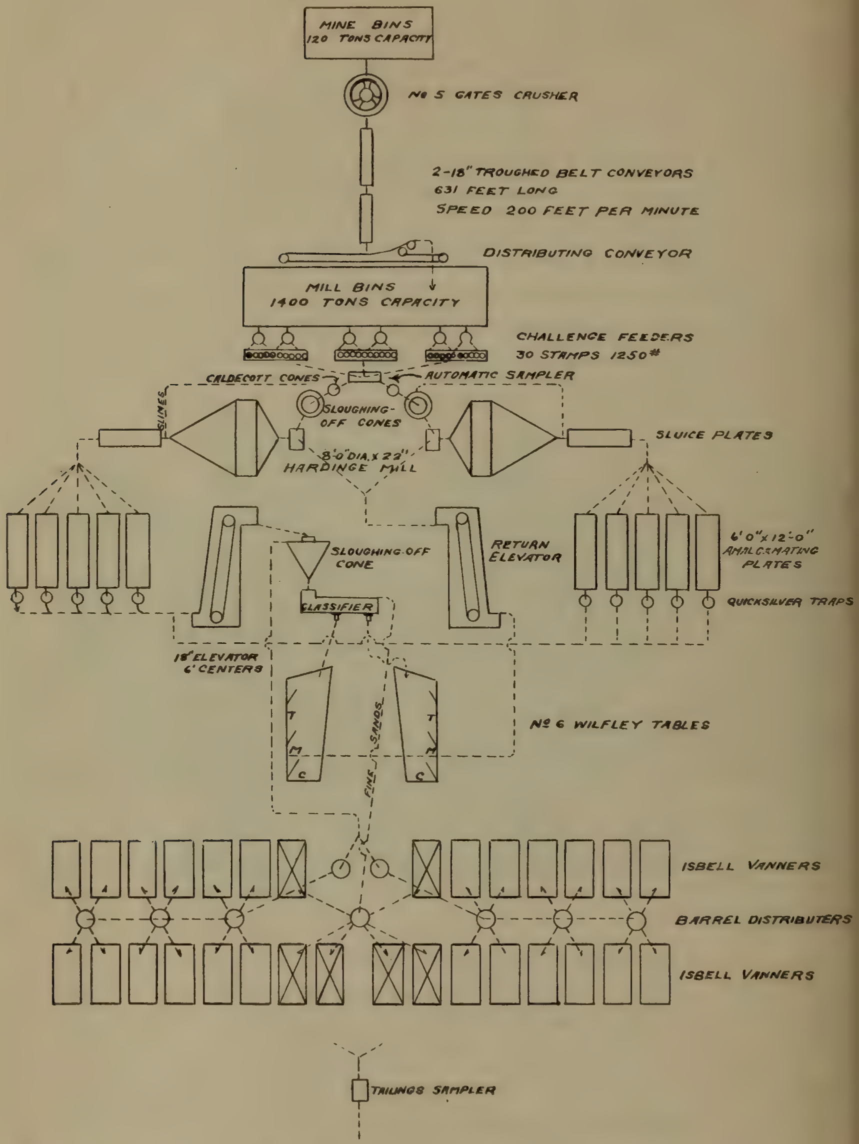
Headframe at Pacific Shaft; also showing timber and machine shops. Plymouth Consolidated Mines, Plymouth, Amador County, California.

amalgam traps, and are elevated by 36-foot bucket elevator to 5 feet 8 inches Callow cone; overflow from Callow cone laundered to two barrel type distributors which distribute to twenty-four 6-foot Isbell vanners. The pulp from two upper barrel distributors is laundered to lower barrel distributors. One barrel to each four vanners. Sands from 5 feet 8 inches Callow cone flow to a 2-compartment Richard hindering settling classifier. The overflow from classifier is laundered to two barrel distributors, which distribute to six 6-foot Isbell vanners. Discharge from Richard classifier flows to two No. 6 Wilfrey tables. Middlings from Wilfrey tables returned to Hardinge mills by 22-foot bucket elevator. This combination of stamps and Hardinge mills yields a product, 90% of which will pass through a 40-mesh screen, and the production of slime and calloidal matter appears to be considerably less than is the case in other Mother Lode plants where the ore is crushed directly through a fine screen.

Plymouth Consolidated Mines Company's 30-stamp mill, Plymouth, Amador County, California.

The plant is crushing 300 tons per day but its ultimate capacity is about 350 tons per day. The amalgamation is done on the outside plates. The concentrates from Wilfrey tables have an assay value of $150 per ton, while concentrates from vanners assay $60 per ton. The tailings run about 60 cents per ton. An extraction of 90 per cent is made by amalgamation and concentration. The mill is run by electric power, the Hardinge mills being driven by a 225 h.p. motor while the rest of the mill is driven by 100 h.p. One hundred and fifty-eight men are employed. Plymouth Consolidated Gold Mines, Limited, 20 Copthall avenue, London, England, owners. Albert Burch, general manager. James Parks, superintendent.

Plymouth-Eureka Mine (quartz). It is 1 mile northwest of Plymouth. In diabase formation to west of Mother Lode belt. Shaft 50 feet deep. Two men are employed. J. Ninis, of Plymouth, owner.



Flow Sheet of Plymouth Mill, Plymouth, Amador County, California, by Gelasio Caetani.

Pocahontas Mine. See our Bulletin 18, page 83. This property is $1\frac{1}{2}$ miles east of Drytown and includes the Pocahontas, Edson, and California. A vertical shaft has been sunk to a depth of 620 feet, with six levels. Three veins have been developed in a black tufaceous slate. There is a steam hoist and 10-stamp mill on the property. Idle. W. F. Detert, of Jackson, and Allen McWayne, of Drytown, owners.

Posey Hill Mine (placer). It is 5 miles northeast of Volcano. Idle. George Hadley, Volcano, owner.

Rancheria Mine (placer). It is 5 miles northwest of Volcano. The channel is 200 feet wide with a depth of gravel of 6 to 8 feet, which is capped by an andesitic tuff 150 feet thick. Bedrock tunnel 500 feet in length. Four men are employed. Elmer Evans et al., of Volcano, owners.

Red Cloud Mine (quartz). It is 2½ miles northeast of Plymouth, adjoining the Easton mine on the north. Workings consist of an incline shaft 275 feet deep. Idle. Glauch Bros. et al., of Oleta, Cal., owners.

Red Cloud Mine (hydraulic). It is situated 12 miles southeast of Ione. Hydraulicking a 6-foot bank of loose gravel wash. Four men are employed. Edgar Ekel, of Lancha Plana, owner.

Red Tape Mine (quartz). It is 6 miles south of Volcano, on ridge north of the North Fork of the Mokelumne River. Includes the Red Tape, Silver Pick, and Oro Grande. The vein has a course of north and south, cutting the granodiorite formation. Workings consist of a shaft 110 feet deep and a tunnel 500 feet in length, 100 feet below collar of shaft. Four men employed sinking shaft. Oscar Lofstead, of Defender, owner.

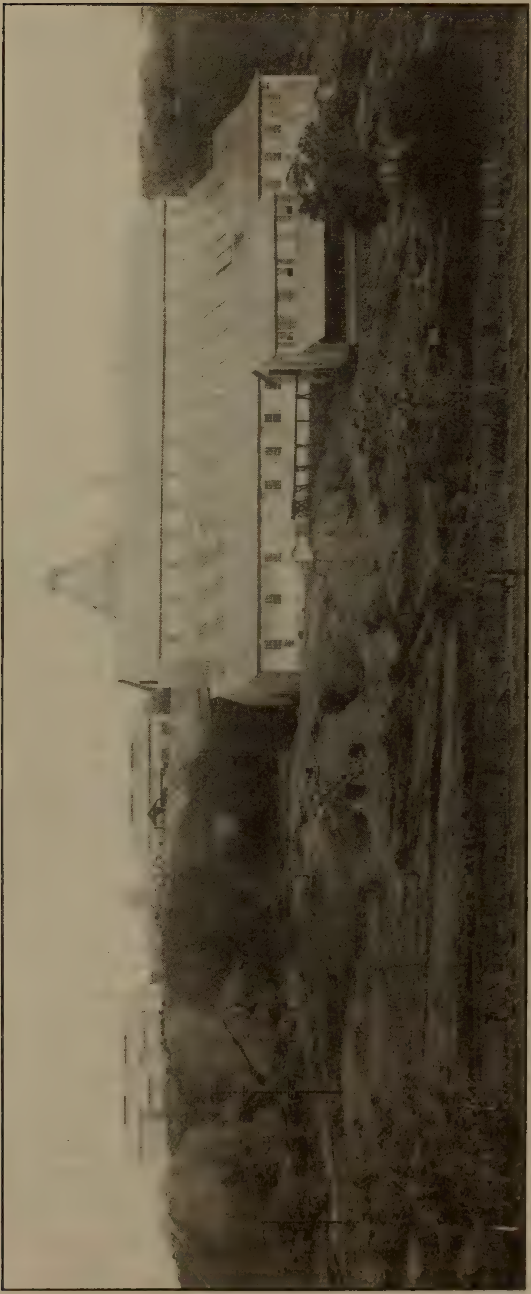
Reward (Clough) Mine (quartz). It is on the Clough ranch, ¾ of a mile east of Pine Grove. Incline shaft 100 feet deep. Idle. Reward Gold Mining Company, 519 California street, San Francisco, owner.

Sargent and Marlette Mines (quartz). The property is situated 4 miles south of Jackson, on Mokelumne River. Workings consist of an incline shaft 120 feet deep on Sargent claim. On the Marlette claim there is a crosscut tunnel 170 feet to vein, with drift north 300 feet and a winze 200 feet deep in north drift. Idle. Mrs. Julia Sargent, of Jackson, owner.

Seaton Mine (quartz). It is 1 mile east of Drytown. The vein is distinguished by a massive outcrop of quartz, occurring on the contact between the Mariposa slates on the west and diabase on the east. There is a shaft sunk on the vein to a depth of 950 feet, on an angle of 65°. Idle. A. Hayward Estate, of San Francisco, owner.

Shenandoah (Easton) Mine (quartz). It is 1½ miles northeast of Plymouth. A shaft was sunk on the vein to a depth of 1200 feet on angle of 58°. No pay ore was developed. Mrs. Hilda Brown, of New York City, owner.

South Eureka Mine (quartz). See our Reports X, p. 113; XI, p. 144; XII, p. 79; Bulletin 18, pp. 63, 64. This mine is 1 mile south of Sutter Creek, adjoining the Oneida on the north. The slates are capped with a Neocene andesite about 25 feet in thickness, so there are no croppings of the vein where the shaft was sunk. The vein is a northern exten-



Steel headframe and mill at the South Eureka Mine, Sutter Creek, Amador County, California.

sion of the Kennedy, Argonaut, and Oneida lead. The north shaft is down 2785 feet on a 67° incline. There are two hoisting compartments 5′x4′ and a manway 5′x2′ in the clear. The south shaft is 880 feet southeast of main shaft, and has a vertical depth of 600 feet. Three veins have been developed, namely: hanging-wall, footwall, and middle, which occur in the black slates and greenstone schists. Numerous lenses of greenstone are encountered in the slates, which fault the vein. The north shaft intersects the hanging-wall vein at 1700-foot level, from which point the shaft was sunk on the vein to the 2000-foot level, the remaining distance being in the footwall of the vein. At a point below the 2000-foot level, the middle and footwall veins form one ore body. Most of the pay ore developed on lower levels is found on the latter vein. The ore shoots have a trend towards the north. Ore is hoisted from the mine in 2-ton skips by double drum electric hoist driven by two 400 h.p. motors with 24-rope transmission drive. Two (16″x14″) (10″x14″) Ingersoll-Rand compressors, each driven by 100 h.p. motor, furnish air for drills.

Mill: This mill contains 80 stamps, weighing 1150 pounds, dropping 6½ inches, 100 times per minute, crushing 5 tons through 24-mesh screen. Each battery of 20 stamps is driven by a 50 h.p. General Electric Company motor. Pulp from amalgamating plates is treated on forty-eight 6-foot Frue vanners. An extraction of 85% is made by amalgamation and concentration, with a loss in the tailings of 54 cents per ton. The concentrates recovered have a value of $100 per ton. The total operating cost per ton is $2.80. South Eureka Mining and Milling Company, owner, San Francisco National Bank Building, San Francisco. W. H. Schmal, superintendent.

South Jackson Mine (quartz). It is ½ mile southeast of Jackson. Three veins have been developed on this property: West, Middle and Zeila. The Zeila vein occurs on the contact between the black clay slates and the amphibolite schist, while other veins occur in the slates to the west. A 3-compartment, 5′x12′ in clear, vertical shaft has been sunk to a depth of 577 feet, with levels at 210 feet, 345 feet and 500 feet. On the 210-foot level a crosscut has been driven 90 feet west. At the 345-foot level, a crosscut is driven west 280 feet cutting a vein 80 feet west of shaft, which has been drifted on 312 feet north and 383 feet south. The vein in both faces shows a width of 5 feet of quartz with a gouge on the footwall. On 500-foot level a crosscut has been driven east 1035 feet, cutting middle vein 20 feet wide, with a drift north on this vein for a distance 260 feet, and south 130 feet. In this crosscut the Zeila vein was cut 750 feet east of shaft, with a drift north on it for a distance of 100 feet.

Equipment: 50-foot headframe, double drum electric hoist driven by 75 h.p. General Electric motor, 16″x12″ Chicago Pneumatic Tool Company compressor driven by 75 h.p. motor. Four men are employed on development work. South Jackson Mining Company. J. Schweitzer, superintendent.

Headframe at the South Jackson Mine, Jackson, Amador County, California.

South Spring Hill Mine (quartz). See our Reports VIII, p. 80; X, pp. 73, 98; XI, p. 145; XII, p. 79; Bulletin 18, p. 77. It is ½ mile south of Amador City, adjoining the Keystone on the south. Comprising the Medean, South Spring Hill, Talisman claims, also the Gorton ranch. There are three shafts on the property: South Spring Hill shaft is 1200 feet, Talisman 600 feet, and Medean 600 feet in depth. The two former shafts are sunk on the contact vein with the Mariposa slates on the west, and diabase on the east, while the latter shaft is on a parallel lead to east in the greenstone. Idle. South Spring Hill Mining Company, owner, Lemonston, Mass. John R. Tregloan, of San Francisco, agent.

St. George Mine (quartz). It is a prospect 1½ miles north of Plymouth. Idle. Thomas George et al., owner, Plymouth, Cal.

St. Juneau Mine (quartz). It is 4 miles south of Jackson, on the "black metal" belt to west of the Mother Lode. There is a tunnel 1000 feet in length on property. Idle. A. Caminetti, of Jackson, owner.

Sunnyside Mine (drift). It is 2 miles south of Oleta. The gravel is partially cemented. Workings consist of a bed rock tunnel 700 feet in length. It is on the same channel as the Clark mine. Two men are employed. W. S. Clark, owner, Oleta.

Sutter Creek (Treadwell) Mine (quartz). It is 5 miles west of Volcano. The vein has a course of N. 25° W. dipping 80° E. Average width of vein is 3 feet. The formation is slate. The vein has been developed by three tunnels, 300, 200 and 200 feet in length. There is a 5-stamp mill on the property. Idle. J. J. Hall, J. B. Grillo, owners, Volcano.

Tellurium Mine (quartz). See our Report XII, page 79. It is 1 mile north of Pine Grove. Vein strikes northeast and southwest dip 65° E. Average width of 2 feet. The formation is a mica schist. Workings consist of a shaft 300 feet deep and tunnel 1450 feet in length, connecting with shaft on 200-foot level. Idle. W. S. Straub, of Oakland, owner.

Tierakoff Mine (quartz). See our Report XII, p. 92. Situated 5 miles southeast of Volcano. In granodiorite formation. Comprising Golden Eagle, Lucky Girl and Badger claims. Tunnel on the Golden Eagle claim being a crosscut 400 feet to vein with drift north on vein for 500 feet. Tunnel 250 feet in length on Lucky Girl claim. There is a 5-stamp mill on property. Three men are employed. W. A. Marchand, owner, Defender.

Treasure (Hazard) Mine (quartz). See our Report XII, p. 77. Situated 1½ miles north of Amador City. The vein occurs on the contact between the Mariposa slates on the west and meta-andesite on the east. A hanging-wall and footwall veins have been developed, also a schist ore body to south of the shaft on the 1000-foot level. The Treasure shaft has been sunk to a depth of 1650 feet on a 50° incline, with levels at 375, 810, 1000 and 1600 feet. On 375-foot level there is a drift north 500 feet and south 500 feet on vein. At 810-foot level there is a crosscut west to vein a distance of 70 feet, with drift north

The Treasure Mine, showing hoist and headframe, Amador City, Amador County, California.

350 and south 300 feet. On 1000-foot level, crosscut west 80 feet from shaft to vein, with drift north 700 feet and south 800 feet. At 1600-foot level, crosscut 120 feet west to vein with drift south 400 feet and north 300 feet. A schist ore body has been developed on the footwall of gouge on 1000-foot level south forming an ore body 700 feet long and 18 feet in width.

On this level the hanging-wall and footwall veins form a juncture with main vein 250 feet south of shaft, but to the north the values pinch out, although the gouge continues. The main vein is in the slates to the 400-foot level, and has a dip of 45° at which point it straightens, having a dip of 65° to 70° each and passes into a schist formation. Two shoots of ore have been developed on main vein having an average width of 6 feet, with a length of 90 to 400 feet. A record in shaft sinking on the Mother Lode has been made at this mine, both in regard to cost and speed. Cost in sinking shaft 9′ by 4½′ in clear of timbers, and 12½′ by 6½′ in clear of rock. The distance sunk being 618 feet.

Labor	$8 03	per foot	$1 07	per ton
Top labor	3 86	" "	0 51	" "
Overhead charge (superintendent, city office, insurance)	2 22	" "	0 29	" "
Powder	3 42	" "	0 45	" "
Timber (10″x10″)	0 96	" "	0 12	" "
Power	1 58	" "	0 21	" "
Vent pipe 12″ diameter, 20 gauge	0 43	" "	0 05	" "
Track spikes, etc.	0 77	" "	0 10	" "
4″ black iron air pipe	0 35	" "	0 04	" "
Electric exploders	0 06	" "	0 003	" "
Fuse	0 01	" "	0 001	" "
Coal	0 22	" "	0 030	" "
Calcium carbide	0 05	" "	0 007	" "
Water	0 026	" "	0 003	" "
Oils, grease, waste	0 060	" "	0 007	" "
Depreciation: 4-B.A. Ingersoll hand drills	0 350	" "	0 047	" "
Extras for drills	0 044	" "	0 006	" "
Steel, broken, lost and used	0 457	" "	0 061	" "
Five 50-foot lengths of hose	0 078	" "	0 010	" "
Shovels, picks and winches	0 019	" "	0 002	" "
Placing 400 feet of pipe	0 019	" "	0 003	" "
Placing 1236 feet 3-8″ bell rope	0 099	" "	0 013	" "
Telephone charge	0 026	" "	0 003	" "
Total cost	$23 65	per foot	$3 15	per ton

Average footage made per month was 110 feet. The average number of hours to drill and fire a round of twenty-one holes having a depth of 3.7 feet was 7.26 hours. The drills used in sinking operations were 4-B.A. 26, Ingersoll-Rand hand operated butterfly valve drills. Fourteen men employed. Treasure Mining Company, 1128 Merchants Exchange Building, San Francisco, owner. E. S. McCurdy, superintendent.

The Zeila Mine, Jackson, Amador County, California.

Valparaiso Mine (quartz). It is 4½ miles south of Jackson, comprises the Wedge, Media and Valparaiso claims. Situated on what is termed the "black metal" belt. Mined for rich pockets encountered in a belt of black slates west of the Mother Lode. Workings consist of a tunnel 1300 feet in length, with a winze 130 feet deep, about 750 feet from mouth of tunnel. Idle. D. Boro, E. Garibaldi et al., owners, Jackson.

West Eureka (Alpha) Mine (quartz). At Sutter Creek, adjoining the "Old Eureka" claim on the east. Developments consist of a shaft 100 feet deep, and crosscut tunnel 85 feet in length, which cut a 20-foot vein, with drift south on vein for a distance of 200 feet. The south drift intersects the shaft at a depth of 30 feet from surface. Idle. John Ross, E. D. Botta et al., owners, Sutter Creek.

Wildman Mine. (See Lincoln.)

Zeila Mine (quartz). See our Reports VIII, pp. 68, 85; X, pp. 68, 104; XI, p. 139; XII, p. 80; XIII, p. 79; Bulletin 18, pp. 45–50. Situated in the southern limits of the town of Jackson. Comprises the following claims: Coney and Bigelow, Blue Jacket, Flemming; also Trowbridge, Nunner and Keeney ranches, with 5280 feet on the lode. This mine is on the east vein of the Mother Lode, confined to a contact of a narrow strip of slatey Calaveras schist on the west and the main belt of amphibolite schist on the east. A diorite dike 4 to 5 feet wide accompanies the vein. The vein has an average width of 20 feet with dip of 60° E. The ore is low grade, averaging less than $4 per ton. The shaft has been sunk 1700 feet on an angle of 65°. On the 1570-foot level a drift has been driven 3000 feet north, where a winze was sunk on the vein to a depth of 458 feet. At a depth of 157 feet below this level, there is a drift 352 feet north on the vein. Also at a depth of 295 feet, the vein has been developed for a distance of 450 feet north. This property has been recently closed down, after 30 years of continuous operation. All machinery is being dismantled and sold. Zeila Mining Company, Jackson, owner. W. F. Detert, of Jackson, agent.

IRON AND MANGANESE.

Two miles west of Ione there is a large deposit of impure hematite in the Ione formation. There is also a deposit in the Calaveras formation about ½ mile northwest of Clinton.

LIME AND LIMESTONE.

There are numerous lenses of limestone in the Calaveras formation in this county.

Amador Lime Rock Company Quarry. Situated about 4½ miles northeast of Ione, on the Bonham ranch. The deposit is a compact blue gray, stratified limestone, which is quarried by hand. This deposit shows a thickness of more than 100 feet. The lime is burned for local use in an intermittent stone kiln. Three men employed. Amador Lime Rock Company, owner, Jackson. W. F. Detert, manager.

Hodge Limestone Quarry. In Sec. 33, T. 7 N., R. 10 E., about 3 miles north of Ione. The croppings can be traced on this ranch for over ½ mile, with a width of 150 to 200 feet. Idle. Alexander Hodge, owner.

MARBLE.

Amador Marble Quarry. Situated 2½ miles east of Plymouth, in canyon of Dry Creek. The marble occurs in a heavy ledge, about 100 feet thick, lying in a schist formation. The quarry face is a little over 100 feet in height and about 100 feet wide. The stone is a light gray and blue clouded marble. Idle. T. A. Dal Porta, owner, Plymouth.

Carrara Marble Quarry. The quarry is located in Sec. 29, T. 7 N., R. 12 E. The principal product is white marble with black streaks. Idle. C. Dondero, owner, San Francisco.

SANDSTONE.

Barnett Sandstone Quarry. See our Bulletin 38, p. 117. In Sec. 27, T. 5 N., R. 10 E., Richard Barnett, Ritchey post office, owner; about 8 miles south of Ione. The products are red and white sandstone. The quarry face on red sandstone shows a maximum thickness of from 18′ to 20′ in one massive bed, which lies with a slight dip to the north. About 100 yards north of the red sandstone quarry, and from 30′ to 40′ higher on the hill, a small opening has been made into a massive snow-white sandstone. The thickness of this stone exposed is about 10 feet. It is a beautiful building material and is pure and free from iron.

TALC.

On the Tonzi ranch 6 miles northeast of Ione, in Sec. 4, T. 6 N., R. 10 E., there is a deposit of light green talc, which outcrops in several places. Joseph Tonzi, of Ione, owner.

CALAVERAS COUNTY.

Field work in March, 1914.

Introduction.

Calaveras County is bounded on the north by Amador, on the east by Alpine, on the southeast and south by Tuolumne, on the southwest and west by San Joaquin County.

The Mokelumne River, on the northwest, separates Calaveras from Amador County, while the Stanislaus, on the southeast, separates it from Tuolumne. It is the central one of the Mother Lode counties, and it is centrally located relative to the entire auriferous slate belt of the Sierra Nevada slope.

All physical conditions are favorable to mining, there being an abundant supply of timber and water. The county is richly mineralized throughout, presenting several belts and districts.

The Mother Lode crosses the county along a thirty-mile course, and in this county displays the characteristics of vast bodies of low and medium grade ore, presenting mining propositions of the sort now especially attractive to conservative mining capital. On this lode, at the northern side of the county, is the noted Gwin mine; by the southern boundary is the Melones, one of the largest mining properties in the State, and between them is the Angels Camp group of mines consisting of the Utica group, one of the ranking gold mines of the country, also the Angels and Lightner mines; with other important mines intermediate along the lode.

The east and west belts are noted for gold resources, which are now attracting marked attention. The auriferous gravel deposits of the ancient river channels aggregate over fifty miles in length, and there has been an increased activity in placer mining in these channels, especially in the neighborhood of Mokelumne Hill, which camp promises to be a large gold producer again.

Three dredges are under active operation on the Calaveras River near the town of Jenny Lind, another dredge is in operation on the Mokelumne River near Comanche, and active prospecting operations are under way to open up new dredging ground on both these rivers.

Besides being notably rich in gold, Calaveras possesses large and valuable copper mines, and deposits of clay, iron ore, limestone, marble and sandstone.

Railway Facilities.

The county has the advantage of direct communication with the principal trade centers by means of railroads, which enter the county at three different points—on the north at Valley Springs, farther south at Milton, and on the extreme southern end at Melones. From the

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CALAVERAS COUNTY. Table of Mineral Production.

Year	Gold	Silver	Copper		Mineral paint (ochre)		Clay		Mineral water		Limestone		Chrome		Quartz crystals	Miscellaneous and unapportioned	
	Value	Value	Pounds	Value	Tons	Value	Tons	Value	Gallons	Value	Tons	Value	Tons	Value	Value	Kind	Value
1880	$320,865	$643															
1881	800,000	1,200															
1882	670,000															Unapportioned, 1900–1909	$50,075
1883	500,000																
1884	485,000																
1885	527,538	2,558															
1886	639,457	4,926															
1887	640,417	1,477															
1888	580,000	1,500															
1889	592,243	1,071															
1890	618,821	2,499															
1891	738,883	4,860															
1892	794,531	24,441															
1893	1,669,192	122															
1894	2,119,365	5,183	654,866	$64,951	115	$2,530											
1895	1,717,916	77	175,895	16,925													
1896	1,546,398	500	87,557	8,990													
1897	1,439,861	1,745			150	2,400											
1898	1,019,023	3,462	18,400	2,052	100	225											
1899	1,265,564	9,813	165,484	27,586													
1900	1,649,126	80,762	980,934	150,585	400	3,800									$18,000	717 tons pyrites	3,583
1901	2,024,685	44,687	1,701,389	268,000	125	500									17,500		
1902	2,072,939	46,234	2,087,501	251,062	259	778											
1903	1,904,125	68,280	2,246,675	297,263	200	1,000											
1904	1,789,184	65,611	2,592,124	414,399	70	385	100	$100			Lime, 3,500 bbls.	$5,500	25	$375			
1905	1,836,816	78,859	3,636,810	572,022	379	1,900	40	300			Tons, 3,087	15,430	20	300	10,000		
1906	1,644,234	74,099	5,082,320	956,315			50	250			3,994	7,635	40	280		13.9 ounces platinum	250
1907	1,097,974	54,420	3,941,883	609,203							6,872	16,955			10,000		
1908	1,378,511	62,727	4,804,446	555,704	50	250	25	250			14,165	31,446			10,000		
1909	1,440,511	71,418	5,438,908	690,632			100	500			4,590	11,987					
1910	1,147,705	82,866	7,345,321	778,369			30	250			6,283	16,976					
1911	1,112,315	67,032	6,190,153	773,769			50	200	10,000	$5,000	3,943	11,733				220 pounds lead	10
1912	932,145	70,748	6,125,415	1,010,693			4,281	4,431	7,528	3,764							
1913	1,175,208	61,076	5,063,187	784,794	28	190	2,000	4,500	11,500	5,500	2,000	1,400				2,500 pounds graphite 7,006 pounds lead Other minerals	25 308 9,900
Totals	$39,920,552	$994,896	58,369,268	$8,233,314	1,876	$13,958	6,676	$10,781	29,028	$14,264	44,934	$119,062	85	$955	$65,500		$64,151

Total Mineral Production, 1880 to 1913, inclusive.

Chrome	$955
Clay	10,781
Copper	8,233,314
Gold	39,920,552
Lime	5,500
Limestone	113,562
Mineral paint	13,958
Mineral water	14,264
Quartz crystals	65,500
Silver	994,896
Miscellaneous and unapportioned	64,151
Total	$49,437,433

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different railway points there are good automobile and wagon roads to the mining districts.

Mineral Resources.

The mineral resources of Calaveras County consist of asbestos, chrome, clay, copper, gold, limestone, marble, mineral paint, mineral water, platinum, pyrite, quartz crystals, stone industry and silver.

ASBESTOS.

California Asbestos Mine. Situated 6 miles southeast of Copperopolis on ridge northwest of the Stanislaus River, in Secs. 21, 22, T. 1 N., R. 13 E., there is a small deposit of asbestos in a belt of serpentine, upon which a small amount of work has been done, but as yet no marketable amount has been developed. The fiber is very short, usually from ½ inch to 1½ inches in length. Idle. California Asbestos Company, San Francisco, Cal., owners.

CHROME.

Chromite deposits near Valley Springs. The chromite deposits near Valley Springs occur in the central belt of discontinuous serpentine areas, extending in a northwesterly and southeasterly direction through southwestern Calaveras. The portion of the belt near Valley Springs is parallel to and just west of the Mother Lode district. The chromite deposits occur at intervals along the serpentine belt in this district and continue to the north and south. The Valley Springs deposits are in several groups, south, east and north of Valley Springs.

Vogelsang Ranch. The chrome deposits on the Vogelsang ranch are about a mile south of the Calaveras River and about five miles southeast of Valley Springs. They consist of a series of lenses of varying size in serpentine arranged along a trend of approximately N. 45° W. Chromite can be traced for from 600 to 700 feet along the strike; in this distance five to six lenses outcrop. All have their larger diameter parallel to the strike and are separated from one another by barren stretches of several hundred feet. The largest lens has a width of ten feet and a length of from 40 to 50 feet. The lenses are nearly vertical or dip to the northeast; they occur in the serpentine 25 feet from its contact with the amphibolite schist, the string of deposits running along northeast of this contact and nearly parallel with it.

The ore is very pure, glossy black and coarsely crystalline. It is hard, heavy and massive and can be removed in large fragments. These lenses are very irregular in their occurrence. The contact of the chrome and serpentine is sharp, little or no chrome occurring in the wall rock, and no serpentine in the ore. Some ore was shipped from these deposits in the past for use as furnace linings at the Campo

Seco smelter. The depth of these deposits can not be estimated, but there is at least from 500 to 1000 tons of ore in sight. G. D. Vogelsang & Bros., of Valley Springs, owners.

Other Deposits. Several small occurrences of chrome are about five miles north of Valley Springs and south of Mokelumne River, in a continuation of the same serpentine belt. Other deposits are in isolated serpentine areas on the west slope of Bear Mountain, 10 miles northeast of Milton on the Wright ranch, also on the Tower ranch in Salt Spring Valley, about 9 miles east of Milton.

There is a deposit on the Nassau Copper Company's property, on the Milton and Angels road, 4 miles north of Copperopolis.

CLAY.

A variegated clay of good quality is being quarried at Valley Springs and shipped to the California Pottery Company of San Francisco for making pottery.

COPPER.

Geology of Copper Belt. The copper belt in Calaveras County crosses the western end of the county through the foothills in a northwesterly direction, being separated from the Mother Lode belt by the Bear Mountain Range of mountains, forming two distinct lodes.

The western lode, near the northern end of the county at Campo Seco, a distance of three miles west of the Copperopolis lode, has been extensively developed by the Penn Mining Company group of mines. Showing strong veins in amphibolite schist formation, the ores carry some gold, silver and zinc. In the south side of the county at Copperopolis is what is termed the Copperopolis lode developed by the Calaveras Copper Company group of mines. The formation in which these mines occur is a black pyritous slate in a belt of amphibolite schists. The ores being different from the Campo Seco belt in that they do not carry any gold and silver values. The continuity of this lode is shown by the croppings and numerous shafts sunk along the lode at different points.

Mines.

Bell Prince Mine (copper). Located ½ mile west of Campo Seco; developments consist of three shafts 22, 61 and 100 feet deep. Prospect. Idle. W. H. Gallagher, of Campo Seco, owner.

Bund Copper Mine. It is 7 miles south of San Andreas. Vein occurring on contact of amphibolite schists and serpentine. Three shafts on vein to depth of 50 feet, 75 feet and 108 feet. Idle. Constant Bund of Fourth Crossing, owner.

Campo Seco Mine (copper). Situated 1 mile south of Campo Seco, on the Valley Springs and Penn Mining Company road. Controls the following claims: Great Eastern, Copper King, Copper Queen, Great Eastern Fraction, comprising 53.3 acres. These claims join the Penn Mining Company's property on the east. The veins on this property can be easily traced by the heavy iron gossan capping exposed in many places on the surface. The east and west veins have been developed by two shafts, with depths of 115 and 93 feet. The vein matter is composed of talcose schist, clay and quartz. The ores are copper sulphides associated with pyrite. Idle. Campo Seco Mining and Development Company, Petaluma, Cal., owners. President, R. S. Brown of Petaluma.

Collier Mine (copper). It is located near the Napoleon Mine in the Gopher Range; shaft 100 feet deep. Caved. Geo. McM. Ross, of Stockton, owner.

Constellation (*Constitution*) *Mine* (copper). South of the property of the Penn Mining Company is the Constellation group of mines consisting of the following claims: Meteor, Constellation, West Constellation, and Constellation Placer mine, comprising 117 acres. The Meteor and Constellation are located on the southern extension of the east vein, while the West Constellation is on the west vein. A shaft has been sunk on the Constellation to a depth of 400 feet, and to the south of this shaft one sunk to a depth of 50 feet, cutting a vein 5 feet wide, assaying 3 per cent copper with gold and silver values. There is a boiler, steam hoist and compressor on the property. Constellation Mining Company, San Francisco, Cal., owner. W. V. Manners, president.

Diamond J. Mine (copper). It is 7 miles southwest of Copperopolis, on south slope of Hog Mountain. Shaft 120 feet deep. Idle. L. Shumate, of Copperopolis, owner.

Eagle Mine (copper). On Quail Hill, contains sulphide and carbonate ores. Idle. Mary L. McDonald, of San Francisco, owner.

Edna Mine (copper). Located 2 miles northwest of Valley Springs on the north slope of Table Mountain, shaft 50 feet deep on west vein and a tunnel 150 feet in length on east vein. The veins are capped by massive iron gossan croppings on the surface, which carry gold and silver values. The ores are sulphides associated with pyrite. Two men are employed sinking shaft. D. A. Nuner, of Valley Springs, owner.

Eureka Mine (copper). Prospect, 2 miles northeast of Campo Seco. Shaft 150 feet deep. Idle. W. H. Thacher, of Lodi, Cal., owner.

Holmes Mine (copper). Situated on ridge south of Campo Seco. Quartz vein in amphibolite schist formation, course of vein is east and west, dipping 75° to the south. The ores are chalcopyrite, pyrite, galena, sphalerite with a small percentage of gold and silver values. Developments consist of a tunnel 365 feet long on vein. Idle. W. A. Holmes, of Valley Springs, owner.

Ingomar Mine (copper). Located 1 mile northeast of Campo Seco, on ridge south of Mokelumne River. The vein lies between amphibolite schists and talcose shales, having an average width of 10 feet. The course of vein is N. 30° W. dipping 60° NE., the ore occurring in lens-shaped deposits in the schist. Developments consist of incline shaft 500 feet deep, with levels at 300 feet, 380 feet and 500 feet. There is also a series of shallow shafts and tunnels on the property. The iron gossan croppings were rich on the surface and in the past were extensively worked for the gold values. The property is on the extreme east end of the Campo Seco copper belt. There are boilers, steam hoist, compressor and 10-stamp mill on the property. Idle. Ingomar Mining Company, 54 Auzerais Building, San Jose, Cal., owners.

Napoleon Mine (copper). Located 10 miles southwest of Copperopolis, on Hog Mountain. The vein channel is about 100 feet wide, consisting of diabase and metadiabase to talcose schists. The ore bodies occur in lens-shaped masses from stringers to 20 feet in width. The surface croppings show a heavy iron gossan capping. The ores are copper sulphides mainly chalcopyrite associated with pyrite, with carbonates and oxides close to the surface. In 1881 shipped 1,600 tons of ore which gave an average assay of 11.25% Cu, 0.26 oz. Au, 5.7 oz. Ag. Leaching operations are being carried on, producing a copper cement assaying 75% copper.

Developments consist of a shaft 250 feet deep and a shaft 350 feet west, which is vertical for a depth of 100 feet then sunk on an incline at an angle of 62° to a depth of 300 feet, with drifts east and west on 100-foot, 250-foot, 300-foot, 400-foot levels.

The property is under lease to C. E. Olsen and D. E. Coughanauér, of Stockton, Cal. Peyton Chemical Company, Mills Building, San Francisco, Cal., owner.

Nassau Mine (copper). Situated 4 miles north of Copperopolis on the Copperopolis and Angels road. This property controls two patented claims, Goat Ranch and Goat Ranch Extension; also 1,560 acres of patented agricultural land, a total area of 1,600 acres, with a length of 15,840 feet on the lode. There is an ore zone 100 feet wide, which shows a vein with an average width of 10 feet. Course of vein is N. 35° W., with a dip of 65° NE. The ore occurs in a metadiabase in the form of lenses, consisting of a series of parallel high grade streaks in the schist, with a width varying from a few inches up to two feet. The ores are in the form of copper sulphides associated with pyrite, carrying a small percentage in gold and silver values, and as high as 15% zinc. Two shoots of ore have been developed. Ore shoot south of shaft has the following analysis: Au 0.35 oz., Ag 4.6 oz., Cu 8.3%, SIO_2 42.8%, Zn 2.6%, Fe 8.2%, S 25%.

Analysis of ore shoot north of shaft which shows high zinc values is as follows: Au 0.125 oz., Ag 4.60 oz., Cu 8.29%, SiO_2 40.8%, Zn 15%.

The sulphide zone is encountered within 30 feet of the surface. Developments consist of a vertical shaft having a depth of 280 feet with 95 and 200-foot levels. On the 95-foot level are drifts north 200 feet and south 800 feet. On the 200-foot level is a drift north 240 feet and south 820 feet. Operations consist of mining the high grade streaks and in shipping the ore to the smelter, also leaching with mine water, which water contains 0.68% copper, and a copper cement assaying 75 % copper is being shipped. Cost of freight haul from mine to Angels $2.00 per ton; cost of railroad freight from Angels to Selby smelter, $2.50 per ton.

General analysis of ore shipped is as follows:

Gold	0.20 oz.
Silver	4.60 oz.
Copper	5.22%
Silica	39.00%
Iron	11.90%
Zinc	17.90%

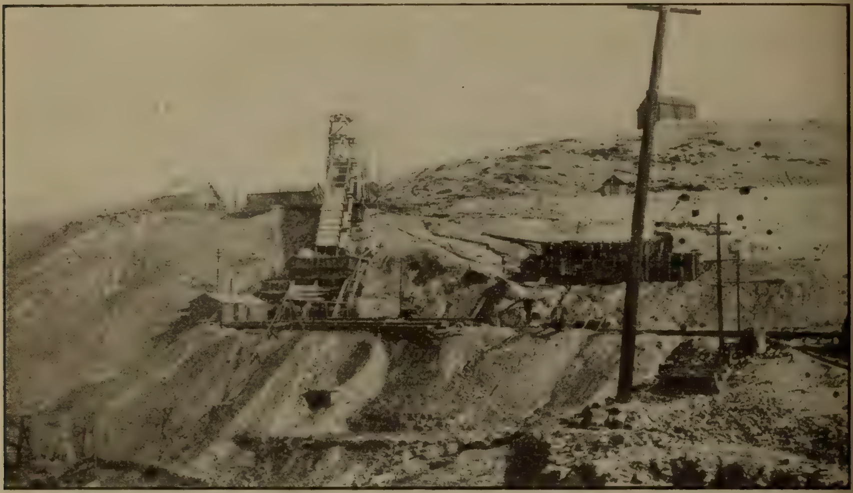
Twelve men are employed. Nassau Copper Company, 339 Bush street, San Francisco, Cal., owner.

Penn Copper Mine. Situated 4½ miles northwest of Valley Springs, the terminus of the Southern Pacific Railroad, and on the western copper belt of Calaveras County. This property consists of four patented mining claims: Campo Seco, Hecla, Satellite, and Little Satellite, comprising 76 acres, also 2200 acres of patented agricultural land, giving 5280 feet on the lode. The veins have a course of N. 30° W. with a dip of 65° NE. The vein matter is composed of quartz, talcose schists and clay. The ores are in the form of copper iron sulphide (chalcopyrite) associated with pyrite and carry a small percentage of gold, silver and zinc.

The general average of ore smelted is as follows: Copper, 5%; gold, $1.10; silver, $1.20; zinc, 5%; iron, 23%.

Two veins have been developed; east vein has an average width of 50 feet. The ore shoot on east vein is 900 feet long with an average width of 15 feet, and a shoot of ore worked on west vein was 1000 feet long, with an average width of 25 feet.

Ore shoots occur in the form of lens-shaped deposits in the schist. The veins have a hard greenstone on both walls. The east and west veins are about 300 feet apart and have the same general course, running in a southerly direction; the ore shoots dip eastward with the veins and also towards the north. The developments on the property consist of five shafts and several tunnels, three shafts on the east vein, and two on west vein. Operations are carried on through No. 3 shaft, which has been sunk on a 74° incline to a depth of 1465 feet on the east vein, and a winze north of shaft with a depth of 465 feet on the vein.

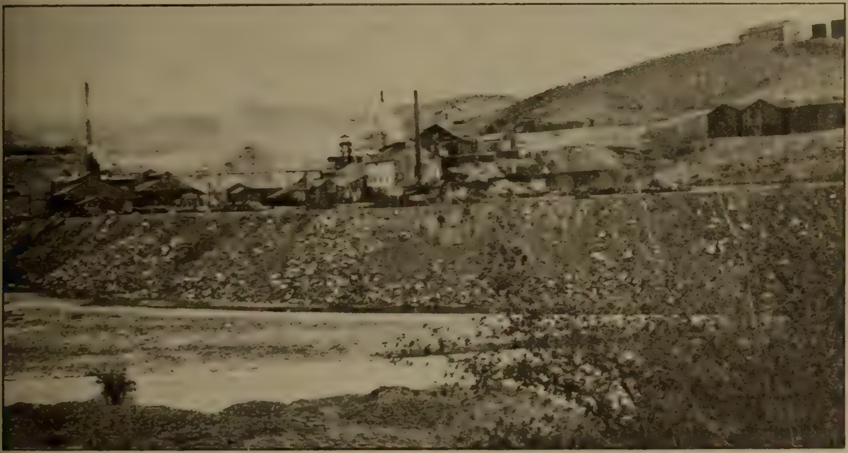


Campo Seco smelter of Penn Mining Company, Campo Seco, Calaveras County, California, showing No. 3 shaft and leaching tanks.

There are eleven levels 150 feet apart, with drifts north and south on the vein. No. 2 shaft on west vein has been sunk to a depth of 750 feet, having nine levels 100 feet apart, with drifts both north and south on the vein. Shaft No. 3 is about 1300 feet north of shaft No. 2. The total amount of underground workings is 29,045 feet.

Campo Seco smelter of Penn Mining Company, Campo Seco, Calaveras County, California, showing crushing plant, bedding bins and roasters.

Reduction plant: The ore is hauled from mine bins in 5-ton cars by 25-ton locomotive to crushing plant, where the ore is crushed by No. 3 type D Gates gyratory crusher to 1½-inch size; crushed product is elevated to 18″x72″ trommel and screened to ⅝-inch size, oversize from trommel to 24″x36″ McFarland rolls, fines conveyed to bedding bins having a capacity of 2100 tons. Product from rolls elevated to 18″x24″ trommel, screened to ⅝-inch size, the oversize to 12″x24″ rolls, rescreened and fines conveyed to bedding bins by 12-inch Robins belt conveyor. The ore is trammed from bedding bins to 8 McDougall roasting furnaces, capacity being 140 tons per twenty-four hours. The calcines are trammed from McDougall roasters in 1½-ton cars to two (23′x66′) reverberatory furnaces having a smelting capacity of 150 tons. Waste heat from the reverberatory furnaces used in a Sterling waste heat boiler, generating 175 h.p. which is used in running power plant and 1500 cubic-foot Nordberg compressor. One water-jacket blast furnace (36″x72″) having a capacity of 100 tons. Total smelting capacity of plant is 250 tons. The blast furnace charge on 5% to 7% copper ore is as follows:



Campo Seco smelter of Penn Mining Company, Campo Seco, Calaveras County, California, showing blast furnace, reverberatory furnaces and McDougall roasting furnace plants.

	Pounds.
Ore	1,100
Lime	225
Slag	200
Coke	85

The ore for the reverberatory furnaces is self-fluxing. A high grade matte of 50% to 60% is the final product of smelting operations. Crude oil is used as fuel for the boilers, reverberatory furnaces and the locomotives which haul the ore from the mines to the smelter.

Electricity is generated at the mine and is used for lighting and also for motive power for electric locomotives in the yard for hauling slag pots, etc. About 43 gallons of oil are used per ton of ore smelted. The total consumption of oil amounts to 7700 gallons per 24 hours.

Water supply for plant is pumped from the Mokelumne River by 6″ x 8″ Dean triplex pump through 1500 feet of 4-inch pipe line to storage tanks having a capacity of 60,000 gallons.

The matte is crushed to 1-inch size, sacked and shipped to American Metal Company, of New York City. The company also owns a limestone quarry northeast of Valley Springs. Between 150 and 200 men are employed on this property. Penn Mining Company, 1713 Harris Trust Building, Chicago, Ill., owner. A. P. Busey, general manager; D. C. Smith, superintendent.

Quail Hill Copper Mine. Situated in the Gopher Range, on west copper belt, about 8 miles west of Copperopolis—shaft 150 feet deep. Idle. Jasper McDonald Estate, San Francisco, owner.

Star and Excelsior Mine (copper). It is 7 miles southwest of Copperopolis, adjoining the Napoleon mine on the southeast. The vein is capped by heavy iron gossan from 50 to 100 feet in width. The ores are sulphides and carbonates with gold and silver values. The Star shaft has a depth of 100 feet, the Excelsior tunnel is 180 feet long. Two men are employed. Wm. Nuner, of San Andreas, owner.

Union Copper Mine. Located at the town of Copperopolis, 14 miles southeast of Milton, the terminus of the Southern Pacific Railroad. The property of the Calaveras Copper Company, it comprises three patented claims; Keystone, Union and Empire, giving 8000 feet on the lode, including patented agricultural land comprising a total of 2386 acres. The vein in these claims shows a maximum width of 40 feet, with an average width of 15 feet. The ores are massive sulphides of copper (chalcopyrite) associated with pyrite in a belt of black slates and carry no gold and silver values. The oxide zone extends only to a depth of 30 feet below surface at which point the unaltered sulphide zone is encountered, and there is apparently no zone of secondary enrichment.

Three ore bodies have been developed and worked through the Union shaft to depth of 850 feet; Empire shaft, 280 feet; Keystone shaft, 400 feet; and North Keystone shaft, 300 feet. Ore shoots dip eastward with the vein, also towards the north. The south Union shoot is 300 feet long with an average width of 15 feet. The north Union shoot is 200 feet in length and has an average width of 10 feet. The ore shoot on Keystone shows a length of 100 feet with an average width of 15 feet. The general course of vein is N. 38° W. with a dip of 60° NE.

Ore has been developed on nine levels, and there are 400 feet of drifts, stopes and shafts which are connected.

All operations have been carried on through the Union shaft, but in the future the new Keystone shaft, which has a new steam hoist with a steel gallows frame and steel ore bins will be used as the main working shaft. The property has a record of having shipped 125,739 tons of ore assaying 10% copper from 1861 to 1869.

The amount of copper produced and sold during 1913 was 1,051,659 pounds.

Mine equipment: At the Union shaft is a double steam hoist driven by 150 h.p. electric motor and a 600 cubic foot air compressor. At the Keystone shaft there is a double-drum steam hoist and a 1500 cubic foot Nordberg compressor, which is driven by 275 h.p. electric motor.

The ore is trammed from Union shaft to a 300-ton concentrating mill, a distance of 4000 feet by 25 h.p. electric motor, hauling four five-ton cars, and dumped into mill bins having a capacity of 600 tons. The mill having proven unsuccessful, will be reconstructed. Tests are being made on oil flotation for recovery of the sulphides.

Smelter: A 300-ton sampling works, 40″ x 120″ waterjacket blast furnace, having a capacity of 125 tons. One reverberatory furnace of 150 tons capacity. Two McDougall roasting furnaces (16 feet in diameter) capacity 40 tons each. A 350 h.p. Sterling waste heat boiler. A 1500 cubic foot Nordberg compressor furnishes air for blast and reverberatory furnaces. The storage capacity of bins for blast and reverberatory furnaces is about 1000 tons.

Cost of supplies and freight—

On ores from Copperopolis to Milton	$4 00 per ton
On ores from Milton to Selby smelter	1 25 per ton
On ores from Milton to Kennett	2 75 per ton
Treatment charge	3 00 per ton
Lime (mining and hauling)	2 00 per ton
Coke (haulage and freight)	18 00 per ton
Oil	1 00 per ton
Silica (delivered)	1 75 per ton

Electric power is furnished by Sierra and San Francisco Power Company at a cost of $4.50 per horsepower.

The property is at present shut down on account of financial difficulties. With closer transportation facilities this property has a big future as a copper producer.

Thirty men are employed in development work and leaching operations. Calaveras Copper Company, president, Chas. M. Hayden; secretary, Herbert Goff, 87 Ames Building, Boston, Mass., owners. Joseph Hadley of Copperopolis, manager.

Welch and Star Mines (copper). Located 3 miles southeast of Copperopolis on ridge east of Black Creek. The vein is covered by a heavy iron gossan capping carrying both gold and silver values. Ore bodies occur in lens-shaped masses in a schist formation, having a width of from 12 feet to 20 feet.

Developments consist of a shaft 150 feet deep and a 250-foot crosscut tunnel connecting with shaft at 90 foot level. Idle. Peyton Chemical Company, Mills Building, San Francisco, owner.

GOLD.

Geology of East Belt.

The mines, which are found from 6 to 18 miles east of the Mother Lode, occur in the slates of the Calaveras formation and in granodiorite. Cutting the granodiorite are numerous small diorite dikes, which usually cut the veins, showing that they were formed at a later period. The mines in the neighborhood of Glencoe are in the Calaveras formation and those in the West Point district in granodiorite. The veins in the neighborhood of Glencoe generally have an east and west strike and dip to the north. The strike and dip of the veins in the granite are not at all uniform. Sometimes the vein in depth will have an opposite dip from that which it has near the surface. Veins occur along lines of fissuring, which fissures are filled with altered granite and vein quartz. Where the walls of the fissure are 2 to 4 feet apart short rich shoots of ore are formed. For instance, a wedge of quartz forming on footwall will gradually widen out to 2 or 3 feet when it leaves the footwall and will cross the fissure at a low angle and join the hanging-wall where it will pinch. Between the short shoot of ore thus formed and its parting from the footwall, there will be several stringers of quartz, more or less parallel to the foot, while along the footwall a second wedge-shaped vein of quartz will form and repeat the peculiarities of the shoot described. The footwall of these veins is usually well defined, while the zone of fracturing and crushing will extend various distances into the hanging-wall.

Mining districts.

Mountain Ranch Mining District. There is very little activity in quartz or placer mining in the neighborhood of Mountain Ranch. The formation of this district is mica schist and quartzite, veins of quartz being usually intimately associated with porphyry dikes on one wall or the other.

Railroad Flat Mining District. The veins in the Railroad Flat district lie in the mica schist of the Calaveras formation, having a usual strike of northwest and southeast and a dip of 65° NE. The only property under active operation in this district is the Comet mine. In the past there has been quite extensive operations in hydraulic and drift mining on auriferous gravel deposits.

Sheep Ranch and Esmeralda Districts. Veins in these districts usually lie in the dark siliceous slates, in Sheep Ranch district having a general course of northwest and southeast, dipping to northeast. In Esmeralda district the veins have general east and west course and dip to the north.

Vallecito and Douglas Flat Mining Districts. In the mining districts of Vallecito and Douglas Flat outside of a small amount of prospecting there is no activity in placer or quartz mining, the former on account of a shortage of water. Veins in this district occur on contact of granodiorite and slate, or in the granodiorite.

General Geology of the Mother Lode Belt.

The chief interest in mining centers around the Mother Lode belt, which enters the county from the south at Robinson's Ferry, on the Stanislaus River, and leaves it at Middle Bar on the Mokelumne River. The general trend of the Mother Lode belt is northwesterly and southeasterly. This belt, which has been termed the Central Belt of the Mother Lode system of veins, can be distinctly traced by the large quartz croppings at different points along the lode, which are especially noticeable on Carson Hill, Chaparral Hill, also at Angels near the Gold Cliff mine, north of San Andreas at the Gottschalk mine, finally at the Hamby mine four miles southwest of Mokelumne Hill.

On the south slope of Carson Hill there are three distinct veins all more or less curved, which lie chiefly in the fissile amphibolite schists.

The ore bodies of the different mines on Carson Hill, such as Melones, South Carolina, Finnigan, and Morgan, are in the form of a stringer lead, consisting of a broad zone of amphibolite schists heavily impregnated with pyrite and intersected by numerous quartz stringers and veins. This vein is accompanied by a heavy vein of low grade white quartz usually on the hanging-wall side. The general course of these veins is northwest and southeast, with a dip of 50° to 80° NE. The ores are free milling, carrying some galena, and tellurides of gold and silver.

On Chaparral Hill these veins converge in the form of a large outcropping of quartz, the ore bodies being similar in character to those of the Carson Hill district. While in the neighborhood of Angels Camp the Mother Lode system is represented by numerous important veins which fall into two groups, the group of veins around Angels Camp and Altaville, which are in the amphibolite schists, and the group of veins a mile west of this town chiefly in the dark slates belonging to the Calaveras formation. In the former group are located the Gold Cliff, Madison, Etna King, Utica, Lightner, Angels, and Bovee mines.

The ore bodies of these properties are in the form of stringer leads consisting of numerous quartz stringers and veins cutting through the amphibolite schists, which are heavily impregnated with pyrite.

At the Gold Cliff mine the ore body has a working hanging-wall of heavy low grade white quartz, 6 to 10 feet in thickness. In the Angels, Lightner, and Utica mines there is a zone of talc 20 to 100 feet in thickness, with a dip of 30° E., which cut off the ore in the Angels mine between 100 and 200-foot levels, in the Lightner mine between 500 and 600-levels, also in the Utica property at the Stickles shaft at the 1000-foot level, and in the Cross shaft between 1300 and 1400-foot levels. Recent developments have shown that the ore continues under this zone of talc, being slightly faulted, and the ore body having straightened up to a dip of 80°.

General Geology of the West Lode.

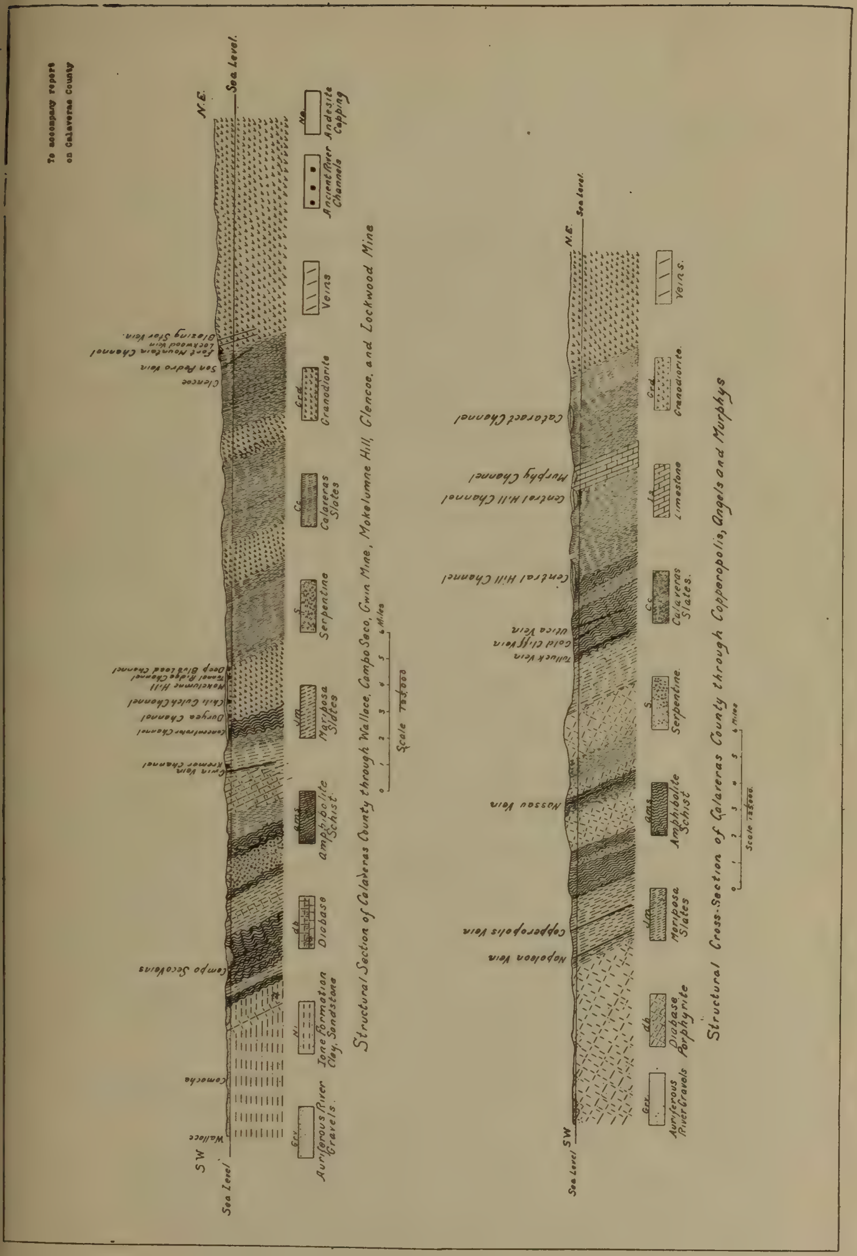
This gold belt extends through Salt Spring Valley from the Alta Mine, located 8 miles southeast of Copperopolis on Stanislaus River, in a northwesterly direction as far as the neighborhood of Valley Springs. The valley lies between Gopher Ridge on the west and Bear Mountains on the east. The formation of the valley consists of foliated black slates of the Mariposa formation, diabase, amphibolite schist and serpentine. The gold-bearing veins usually occurring in the amphibolite schist and black slates.

The veins have a general northwesterly and southeasterly strike with a dip to the northeast, usually flat. The gold-bearing quartz is as a rule associated with dikes, finely granular and light gray in color.

GOLD MINES—QUARTZ.

The Adelaide Mine (quartz). It is located on south slope of Carson Hill, ¼ of a mile east of Robinson Ferry. The workings at this property are on a vein east of the main fissure with a strike of N. 30° W. and dip of 80° E. The ore body between the walls shows a width of 15 feet of talc schists, cut by three distinct quartz veins, the footwall of the vein is greenstone with a hanging-wall of black talcose slate. Mine was opened up by vertical shaft 110 feet deep. Last time the property was under operation was in 1890. B. F. Wood et al., of Melones, owners.

Ætna Mine (quartz). It is 2 miles north of Glencoe, on ridge south of South Fork of Mokelumne River. In granodiorite formation. Workings carried on through two tunnels. Lower tunnel 160 feet on vein. Upper tunnel 250 feet long. East and west vein, dip 75° S. Two men employed. G. A. MacKisson, of Rich Gulch, owner.



Structural Section of Calaveras County through Wallace, Campo Seco, Gwin Mine, Mokelumne Hill, Glencoe, and Lockwood Mine

Structural Cross-Section of Calaveras County through Copperopolis, Angels and Murphys

Afterthought Mine (quartz). Located at Railroad Flat, on ridge north of Little Spruce Creek. Incline shaft 140 feet in depth, tunnel 300 feet long. Idle. Aaron Cook Estate, of Mokelumne Hill, owner.

Alexander Mine (quartz). It is 3 miles south of Glencoe, on ridge north of the North Fork of Mokelumne River. Tunnel 870 feet long, shaft 50 feet deep. Idle. W. P. Craig, care of H. S. Crocker Company, 565 Market street, San Francisco, owner.

Alpha and Omega (*Greek*) *Mine* (quartz). It is 3 miles north of Mountain Ranch, on ridge between Jesus Maria and Esperanza creeks. Shaft 175 feet deep. Property being reopened. There is a 5-stamp mill on property. Two men employed retimbering shaft. J. B. Medina, C. F. Bennett, of Mokelumne Hill, owners.

Alpine Mine (quartz). Three miles southwest of Mountain Ranch. Two tunnels on vein, 90 and 150 feet in length. Mrs. Mary Swank, of Mountain Ranch, owner.

Alta Mine (quartz). Situated 8 miles southwest of Copperopolis, on ridge northwest of the Stanislaus River. The formation consists of a broad zone of black mineralized slate cut by numerous quartz stringers, which was extensively mined as shown by two large open cuts. This ore zone is from 20 to 100 feet in width. Vertical shaft 387 feet deep, and on the 287-foot level there is a drift 300 feet north and 600 feet south, through which the ore from the two open cuts was extracted. Equipment consists of 8 h.p. boiler, double-drum steam hoist, 8-inch Cornish pump, 12″x18″ Laidlaw-Dunn-Gordon compressor driven by 75 h.p. motor.

Mill: No. 3 Gates gyratory crusher, 40-stamp mill, 950-pound stamps, 8 Standard concentrating tables, driven by 100 h.p. motor. Idle. California-Calaveras Mining Company, E. L. Flower, Milton, agent.

American Eagle Mine (quartz). It is 4 miles southwest of Railroad Flat, on ridge west of Nelson Gulch. Strike of vein east and west, dip 65° N. Average width of vein 12 inches. Vein developed by three crosscut tunnels, 500, 80 and 150 feet in length and drifted on east and west. Two-stamp mill on property. Three men employed. Allen W. Doe, of Railroad Flat, owner.

Angels Mine (quartz). See our Reports XIII, p. 141; X, p. 150; XII, p. 89 M and S. P., Nov. 26, 1904.

It is located on Angels Hill in townsite of Angels Camp. Consists of six patented claims and one placer claim: Billings, Crystal, Oneida, Dr. Hill, McCormick, Angels, and Beda Blood placer claim, a total of 101.15 acres. Property is operated through a three-compartment shaft 850 feet deep. There is also the Crystal shaft, 600 feet deep, which is used for lowering timbers. Two veins have been developed on this property called the East and West veins with a strike of northwest and southeast, East vein having a dip of 80° NE. and West vein of 65° NE. These veins have an average width of 20 feet, with a diorite footwall and heavy talcose slate hanging-wall. Ore is hoisted by double-drum electric hoist, and dumped into storage bins in 60-foot gallows frame, passing over grizzly to 10″x20″ Blake crusher. Mining operations are carried on with air drills, air being supplied by a 12-drill Angels Iron Works compressor. Hoist, compressor and rock breaker are driven by 225 h.p. Westinghouse motor. Ore trammed from storage bins at shaft to mill up a 30° incline.

Mill: 40 stamps, weighing 850 pounds each, dropping 7 inches, 104 drops per minute, crushing 5 tons per stamp through No. 1 punched screen. Battery pulp concentrated on sixteen 4-foot Frue vanners. An extraction of 90% is made in mill, the loss in the tailings being $0.20 per ton. Value of concentrates $50 per ton. Concentrates are shipped to Selby Smelting Works, concentrates running under $50 per ton have a freight rate from mine to smelter of $3.25 per ton; concentrates valued at over $50 per ton have a freight rate of $4.25 per ton. Total operating costs are $2.25 per ton. Lumber costs $18 per 1000 feet; round timbers costing $2.15 per stick. Power from Pacific Gas and Electric Company at $4.50 per horsepower. Seventy men are employed. Angels Quartz Mining Company, James V. Coleman, of San Francisco, owner. A. M. Randol, general manager.

Ariel Mine (quartz). Located 2 miles northeast of Mokelumne Hill, on ridge south of Mokelumne River. Series of parallel north and south and east and west veins on property. Work carried on through 600-foot crosscut tunnel. Idle. A. H. McCarty, Harry Schrag, of Mokelumne Hill, owners.

Arthur (French) Mine (quartz). A prospect 4 miles east of West Point, on ridge west of Bald Mountain. Shaft 70 feet deep. Idle. Mrs. Sarah Gallagher, of West Point, owner.

Bachman Mine (quartz). Situated 7 miles south of San Andreas, on the Angels and San Andreas road. Two veins on property, one running northwest and southeast, the other east and west, converging to the northward. Shaft, 478 feet deep, sunk on a 65° incline on east and west vein. Shaft 75 feet deep on northwest and southeast vein, which is 25 to 100 feet wide. Idle. Constant Bund, of Fourth Crossing, owner.

Banner (Grasshopper) Mine (quartz). At Glencoe. Shaft 120 feet deep, caved. Width of vein, 2 feet. Strike east and west, dip 45° N. Idle. Judge Ira Reed, of San Andreas, owner.

Bartola Mine (quartz). It is 2 miles east of West Point, on ridge west of Bear Creek. Shaft 135 feet deep. Idle. John Hansen, of West Point, owner.

Basco Mine (quartz). At Esmeralda, on ridge north of San Antonio Creek. Shaft on vein 100 feet deep and tunnel 200 feet in length. Idle. John Redick, Frank Solinsky et al., Monadnock Building, San Francisco, owners.

Beatrice Mine (quartz). It is 1 mile west of Murphy, on Murphy Ridge between Murphy and San Domingo creeks. Controls five claims: Beatrice, Extension, Roble, Roble Annex, Beatrice Annex. The strike of vein is east and west, dip 70° N. In mica schist formation, Roble shaft 350 feet deep. Beatrice shaft 150 feet deep. Crosscut tunnel 1200 feet long connects with Roble shaft. Idle. C. L. LeTourneau et al., Portland, Ore., owners.

Big Four Mine (quartz). It is 5 miles south of San Andreas and joins the Thorp mine on the north. Idle. Constant Bund, owner.

Big Horn Mine (quartz). (See Report XIII, page 97.) It is 5 miles north of Murphy, on ridge north of San Domingo Creek. Two tunnels on vein, upper 400 feet long, lower 420 feet long, winze on vein in lower tunnel 50 feet deep, giving a total depth of 175 feet from surface. Idle. W. C. Frances, of Portland, Ore., owner.

Big Spring Mine (quartz). (Graam.) It is 1½ miles south of Angels. General course of vein is northwest and southeast, dipping 50° NE. Vein 10 to 100 feet in thickness. Shaft sunk on the vein 100 feet deep. Idle. Norman Smith, C. D. Smith et al., of Angels, owners.

Billy Williams Mine (quartz). It is 3 miles northeast of West Point, on ridge southeast of Skull Flat Gulch. Crosscut tunnel for 200 feet to vein, and drift south on vein for 200 feet. Two men employed. Thomas Jenkins, of West Point, owner.

Black Wonder Mine (quartz). Located 9 miles southeast of West Point, on ridge northeast of Licking Fork of Mokelumne River. Formation black siliceous slate. Course of vein N. 30° W., dip 65° W. The quartz is very heavy sulphretted, containing arsenopyrite, chalcopyrite, marcasite, galena and zincblende. Developments consist of a tunnel 800 feet on vein and a shaft 65 feet deep. Idle. Fred Greeve, of West Point, owner.

Blair Mine (quartz). It is 1¼ miles west of Angels. Shaft 450 feet deep, sunk on the vein, and has been developed for a distance of 150 feet on 150′, 200′ and 400′ levels. Vein strikes northwest and southeast and dips 55° NE., having a width of 12′ to 20′ of ore. Equipment consists of 60 h.p. horizontal boiler, 25 h.p. single-drum hoist, 2-drill Rand compressor.

Mill: Ten stamps, 950 pounds per stamp, 9″ x 12″ Blake crusher. Idle. M. A. Dolano, of Palo Alto, F. Solinsky, of San Francisco, owners.

Blazing Star Mine (quartz). Situated 1½ miles east of West Point, adjoining the Water Lily mine on north. Vein has an average width of 2 feet, strike N. 30° W., dip 80° W. Shaft sunk on vein to a depth of 400 feet. Mine was worked from three levels; on 210-foot level, drift 200′ N. and 200′ S.; on 260-foot level, drift 300′ N. and 150′ S.; on 360-foot level, drift 130′ N. On 260-foot level north at a distance of 150 feet from shaft, a winze was sunk 50′ encountering an orebody 450 feet long with an average width of 3 feet. Vein cut by a series of diorite dikes. Property being reopened. Union Development Company, 713 Iowa Loan and Trust Building, Des Moines, Iowa. W. O. Pray, superintendent.

Blue Bell Mine (quartz). Located 2 miles northeast of Glencoe, on ridge south of the South Fork of Mokelumne River. Claims: Blue Bell, Blue Bell Extension, Crown Point, and Crown Point Extension. Vein on contact of granodiorite and slate, the former being the hanging-wall, the latter the footwall. Width of vein 3 feet, strike N. 20° E., dip 30° E. Work carried on through two tunnels. Elevation of lower tunnel 1700 feet, 600 feet long with 540 feet of drifts and crosscuts. Elevation of upper tunnel 1900 feet, 100 feet in length. Idle. Copa de Oro Mining Company, owners. W. D. Stewart, president and secretary, Garden City Bank, San Jose.

Blue Jay Mine (quartz). Four miles southeast of Mokelumne Hill, on the North Fork of the Calaveras River. Two claims, Blue Jay and Franklin. The course of vein is N. 20° W., with a dip of 45° E. Ore milled from two shafts sunk on outcrop of vein to a depth of 125 feet. A crosscut tunnel 1400 feet in length was driven for the vein but failed to develop any ore. There is a 10-stamp mill on property. Idle. Hesperus Mining and Mining Company, 34½ Beacon street, Boston, Mass., owners.

Bolytho Mine (quartz). (See Report XII, page 93.) This mine is 1 mile south of Angels. Controls 180 acres and includes the Bolytho quartz claim and Figaro Homestead, containing 160 acres. Two shafts on vein to depths of 300 feet and 200 feet. This vein is called the Dead Horse lead, contains a broad zone of amphibolite schist cut by numerous quartz stringers. Ore is free milling, carrying from 2 to 5% pyrite. General strike of vein is northwest and southeast, dipping 60° NE. Idle. Has not been worked for some years. Bolytho Mining Company, of Pittsburg, Pa., owners. E. P. Lynch, president.

Bon Ton Mine (quartz). It is 5 miles north of Murphy, on ridge between San Antonio and Indian creeks. Tunnel 130 feet long. Idle. W. H. Sellsby, C. A. Whitney Estate, of San Francisco, owners.

Boston (Esperanza) Mine (quartz). (See Report XII, page 90.) It is on Indian Creek, 2 miles northeast of Mokelumne Hill. There is an inclined shaft 340 feet deep on property. The mineral zone exposed by the drifts is from 40 to 50 feet wide, consisting of veins, stringers, and large irregular masses of quartz in chlorite and talcose schists. There is a 30-stamp mill on the property. Idle. M. Davidson, of Mokelumne Hill, owner.

Bowden Mine (quartz). It is 6 miles northwest of El Dorado, on ridge west of Salamanda Gulch. Tunnel 150 feet long on vein 5 feet wide. Two men employed driving tunnel. Thomas Bowden, A. Scossa, of El Dorado, owners.

Bright Star Mine (quartz). It is located three miles northwest of San Andreas. The vein has a strike of northwest and southeast with a dip of 70° NE., and occurs in black clay slates. There is a tunnel 200 feet in length driven on the vein. Two men employed. Thomas Jackson, of North Branch, C. Gorgadumie, of Oakland, owners.

Bruce Mine (quartz). It is at Esmeralda, on Indian Creek. Tunnel on vein 400 feet in length. Idle. M. Lengen, L. Gagnon, of Esmeralda, owners.

The Bruner Mine (quartz). (See Reports X, XI, XII.) It is 2 miles south of Angels. Developments consist of shaft 200 feet deep, with levels at 60 and 80 feet and a crosscut to east at 150-foot level, 125 feet in length. Controls eight claims, Apex, Evening Star, Dewett, Spring Gulch, Cold Hill, Romaggi & Costa, Bald Hill. New Discovery. Idle. Overall-Stickle Mining Company, owners. President, Geo. E. Stickle; secretary, G. A. Posey; office, 847 Monadnock Building, San Francisco.

Buena Vista Mine (quartz). It is 1¼ miles west of Copperopolis. The vein has an average width of 10 feet, with a strike N. 10° W. and a dip of 55° W., in amphibolite schist. Developments consist of an incline shaft 185 feet in depth. A tunnel 400 feet long has been driven on vein which connects with shaft on the 90-foot level. Two men employed. Frank Tower, Mrs. A. R. Bowland, of Copperopolis, owners.

Buena Vista (Josephine) group of mines (quartz). They are 3 miles west of West Point, on ridge north of the Middle Fork of Mokelumne River. Crosscut tunnel 150 feet to vein. Tunnel on vein 500 feet in length. Five-stamp mill on property. Four men employed driving east tunnel. V. P. Yeluini, of West Point, E. Peabody and P. M. Boston, 1973 Ninetieth avenue, Elmhurst, owners. E. Peabody, superintendent.

Bullion Mine (quartz). It is 2 miles south of Angels, on Albany Flat. Developments consist of a shaft 200 feet deep and levels north and south on the vein at 100 and 200 feet. Vein a westerly splitoff of the main Mother Lode vein. Frank Pattee, L. L. Doak, of Oakdale, owners.

Bullion Mine (quartz). It is 4 miles north of Murphy, on ridge north of Indian Creek. Vein 12 inches wide in mica schists, strike N. 65° E., dip 80° S. Shaft 60 feet deep. Tunnel 200 feet long. Steve Valente, Paul Lefler, of Calaveras, owners.

The Calaveras Consolidated Mines (quartz). (See Reports X, p. 56; XI, p. 169.) This group of mines is located 7 miles south of Angels, extending from the Stanislaus River up the south slope of Carson Hill, and consists of the following claims: Extension, Relief, Stevens, Brown, Santa Cruz, Mexican, Ivanhoe, Calaveras. All patented and having an area of 140 acres. The workings of this mine consist of a tunnel 1400 feet in length and a shaft 600 feet deep. Strike of vein is northwest and southeast, dipping 65° NE., with an average width of 20 feet of vein material. Mouth of tunnel and shaft caved. All mill and mine machinery have been dismantled and sold. Property being reopened. Eight men employed. Brown, of Napa City, and Newcombe, of San Francisco, owners.

California Mine (quartz). It is 6 miles west of Sheep Ranch, on ridge north of O'Neils Creek. Shaft on vein 80 feet deep and tunnel 96 feet long. Idle. E. Peabody, of West Point, owner.

California-Ophir Mine (quartz). Located in the townsite of Carson Hill, consists of one patented claim, California-Ophir. Vein has a width of 5 feet with a footwall of diabase and hanging-wall of gray slate. Shaft on the property is sunk on 65° incline to depth of 600 feet, the vein opened up on three levels, 200, 400 and 600 feet, and drifted on both north and south for a distance of 400 feet. Property has been idle since 1903. John Raggio, of Stockton, Frank Solinsky, of San Francisco, owners.

Carlton Mine (quartz). It is 2 miles west of West Point, on ridge north of the Middle Fork of the Mokelumne River. Shaft 160 feet deep. Idle. T. Carlton, of West Point, owner.

Caruthers Mine (quartz). It is 4 miles north of Murphy, on ridge south of Indian Creek. Shaft 200 feet deep. Tunnel 200 feet long, connecting with shaft at 200-foot level. Idle. Deserey Frecot, of Sheep Ranch, owner.

Champion Mine (quartz). (See Report XII, page 91.) It is 1½ miles west of West Point, on ridge north of Middle Fork of Mokelumne River. Shaft 900 feet deep, caved. Idle. Mrs. M. Rieffino, of San Francisco, owner.

The Chaparral Hill Group of Mines (quartz). This group of mines is located on Chaparral Hill, 3 miles south of Angels, and consists of five patented claims: Felicie, Chaparral Hill, Rothschild, Vanderbilt, and Bright Star, comprising 80 acres of ground. The footwall of vein is a massive outcrop of heavy white quartz from 22 to 130 feet in thickness, the main ore body consisting of a mass of quartz stringers cutting through a zone of amphibolite schists which are heavily mineralized, containing from 1 to 2 per cent pyrites, also shows some tellurides of gold and silver and arsenopyrite. Most of the work on this ore body has been in surface prospecting. A series of crosscut tunnels has been driven through the ore body. On the Vanderbilt claim there is a tunnel 500 feet long, mostly on the vein. On Chaparral Hill claim there is a 464-foot crosscut tunnel, cutting diagonally across the formation. On the other claims a series of prospect shafts has been sunk along the vein to depths of 50 to 150 feet. Four men are employed in driving tunnel. M. C. Meeker, of Camp Meeker, Sonoma County, owner. F. I. Stevenot, superintendent.

Cherokee Mine (quartz). It is 1 mile northwest of Altaville. Controls 122.6 acres. Idle. B. R. Prince Estate, of Altaville, owners.

Collier Mine (quartz). It is 6 miles east of Murphy. There are 6 tunnels on a vein of dark quartz, containing free gold, pyrite and a little galena. Vein strikes east and west, dip 80° N. The country rock is a hard siliceous slate. Six tunnels, 225, 160, 275, 190, 400, 412 and 300 feet in lengths. The ore is very base in character, containing galena, zinc blende, pyrite, arsenical pyrites, antimony and tellurides of gold and silver. Property has 5-stamp mill, where an attempt was made to mill the ore with poor results. Idle. J. H. Condit, of San Francisco, Mrs. P. A. Malaspina, of Murphy, owners. P. E. Condit, of Murphy, agent.

Columbo Mine (quartz). It is 2½ miles south of Angels. Two shafts have been sunk on vein to a depth of 60 feet. Two men employed sinking shaft. John Ferrari, of Angels, owner.

Columbus Mine (quartz). Three miles northwest of West Point, on ridge southeast of the North Fork of Mokelumne River. Crosscut tunnel 150 feet in length. Shaft 150 feet in depth. Shaft caved. Idle. P. A. McKenzie, of Oakland, owner.

Comet Mine (quartz). It is 2 miles north of San Andreas. A large open cut was excavated here and two crosscut tunnels 300 feet long run to the open cut from the east. Idle. I. H. Reed, of San Andreas, owner.

Comet Mine (quartz). Situated 2 miles north of Railroad Flat, on the South Fork of the Mokelumne River. The formation is a mica schist. Vein has an average width of 18 inches, strike N. 55° E., dip 75° NW. Diabase dike having a course of N. 70° E., dip 65° SW. cuts vein, at intervals being closely associated with the quartz in the fissure. The vein pinches and swells, ore forming in kidneys. The character of the quartz is ribbon rock with 2% pyrite and galena.

Fracturing extends some distance into the walls, making them very irregular. The dike does not appear to cause any enrichment in the vein and appears to be of later origin. Work is carried on through two crosscut tunnels. Lower tunnel 210 feet to vein with a drift 250 feet southwest and one 40 feet northeast. Upper tunnel 96 feet above lower tunnel. Crosscut 96 feet to vein and drift 50 feet northeast and 50 feet southwest. Water supply taken from the Licking Fork of Mokelumne River through 2 miles of ditch and 1400 feet of 10-inch pipe line, giving an available head of 465 feet which runs mill.

Mill: 10″x20″ Blake crusher, 10 stamps, weighing 950 pounds, dropping 98 per minute, 6-inch drop, crushing 1½ tons per stamp through 40-mesh screen. Concentrates saved by 2 Deister sand tables. An extraction of 80% is made. Cost of mining $2.60, milling $1.65, cost of transportation of sulphurets to Selbys $13.50. Fourteen men are employed. F. L. Harrington, of Railroad Flat, owner.

Cornmeal (*Camille*) *Mine* (quartz). A prospect 4 miles south of West Point. An east and west vein, dip 80° N. Crosscut tunnel 100 feet to vein, drift west 200 feet. Idle. D. Fillippini, A. McAllister, of West Point, owners.

Cosgrove Mine (quartz). It is at Angels, only a prospect. Mrs. Kate Cosgrove, of Stockton, owner.

Crossette Mine (quartz). It is 4 miles west of Angels. Controls 40 acres. Vertical shaft 80 feet deep on property. Vein is 18 inches wide and has a strike of northwest and southeast, dipping 40° E. Equipment consists of 35 h.p. upright boiler and a single-drum steam hoist. The property is being developed. Four men are employed. Robert S. Crossette, Ella Bur, of San Andreas, owners. Don Mackey, superintendent.

Crown Point Mine (quartz). Two miles west of Murphy, on Murphy to Angels road. Series of blanket veins striking northwest and southeast, dip 18° NE. Very rich pockets have been taken out, these pockets occurring on contact of vein with a porphyry dike. Tunnel 225 feet long. Eight men employed. Steven Carley, E. A. Black, of Murphy, owners.

Deerfoot (*Gilbertson*) *Mine* (quartz). Located 1½ miles north of West Point on ridge north of Mott's Gulch. Width of vein 12 inches, strike N. 30° W., dip 70° NE. Tunnel on vein 150 feet in length, winze 66 feet deep. Three men employed sinking winze. There is a 5-stamp mill on property. L. A. Rehfus, of West Point, owner.

Deer Lodge Mine (quartz). It is 7 miles east of Murphy, on slope of Stanislaus Canyon. Two tunnels on vein, upper tunnel 100 feet long, lower 200 feet in length. Idle. P. E. Condit, J. N. Condit, of Murphy, owners.

Delmatia Mine (quartz). (See Report XIII, p. 101.) It is 7 miles northwest of Murphy, on ridge between San Antonio and Indian creeks. Vein 12 inches wide, developed by tunnel 100 feet long and a shaft 200 feet deep. Equipment, 35 h.p. boiler, 25 h.p. single-drum steam hoist, 1 drill Giant compressor. Idle. Marco Bozavich, Joe Tremantina, of Esmeralda, owners.

Del Monte Mine (quartz). Located 4 miles southeast of Glencoe, on ridge south of the North Fork of the Calaveras River. In the slates of the Calaveras formation. Vein 2 to 5 feet in width. Strike east and west, dip 85° N. Work carried on through crosscut tunnel 1100 feet long, drifted 285 feet E. and 300 feet W. on vein. Three hundred feet above lower tunnel a tunnel 1200 feet long has been driven on vein. Three shoots of ore developed on upper tunnel 100 feet in length with an average width of 3 feet. No ore developed in lower tunnel. Equipment consists of 3 drill Rix compressor, 60 h.p. boiler, 35 h.p. steam engine, 10-stamp mill. Property being reopened. Six men employed. Del Monte Consolidated Mining and Reduction Company, Meadville, Pennsylvania, owners. Geo. I. Wright, superintendent.

Demarest Mine (quartz). It is five miles west of Angels, near the Copperopolis road. Controls 340 acres under agricultural patent. An incline shaft has been sunk on the vein for a depth of 700 feet and drifted on the 200, 300 and 600 foot levels. Mine equipment consists of two 60 h.p. boilers, 10″ x 12″ single-drum steam hoist, 10″ x 14″ air compressor (350 cubic feet of air).

Mill: 8″ x 10″ Blake crusher, run by 12 h.p. steam engine. Five stamps, weight 1000 pounds each, 2 Pacific vanners. Mill run by 10″ x 12″ steam engine. Idle. Demarest Gold Mining Company; D. C. Demarest, L. Monteverda, of Angels, owners.

Dodson (*Dodson & McQuig*) *Mine* (quartz). (See Report XII, page 92.) It is 1½ miles west of Murphy, on southeast slope of Hulda Mountain. Vein 12 inches wide. The formation is black siliceous slate. Tunnel 100 feet long. Idle. Henry Stienbeck, of Murphy, owner.

Dutchess Mine (quartz). It is 4 miles southeast of Vallecito. Vein lies in granite, striking northeast and southwest, dipping 75° N., having an average width of 3 feet of quartz containing about 8% pyrite. This vein had been developed by a tunnel 1600 feet in length. Ten-stamp mill on property. Idle. William Lilley et al., of Indiana, owners. William Bravin, of Angels, agent.

Easy Bird Mine (quartz). Situated 2 miles northeast of Mokelumne Hill, on ridge southeast of Mokelumne River. Controls the following claims: Easy Bird, Humming Bird, John Pierpont Morgan. Vein has an average width of 8 feet, course east and west, dip 45° N., with a granodiorite footwall and slate hanging-wall. Workings consist of a crosscut tunnel 250 feet to vein, with a drift 1300′ W. and 500′ E. The ore has been stoped out above the tunnel level to surface.

Mill: 10″ x 20″ Dodge crusher, 10 stamps, 1000 pounds each, four 6-foot Frue vanners, mill driven by 25 h.p. Westinghouse motor. Idle. Outlook Mining Company of Boston, Mass., owners.

Economic Mine (quartz). Located 9 miles north of Angels, on San Antonio Creek, at an elevation of 1100 feet. Vein 6 feet in width, occurring in black siliceous slate, with a course of east and west, dip 75° N. Work carried on through tunnel 700 feet long.

Equipment: 2 drill Ingersoll-Sargent compressor operated by 4-foot Pelton wheel.

Mill: 10″ x 20″ Blake crusher, 20 stamps weighing 1000 pounds each, five 4-foot Frue vanners, driven by 6-foot Pelton wheel. Water supply taken from San Antonio Creek by fourteen miles of ditch and pipe line. Electric machinery is being installed to run mill. Thirty men are employed. Standard Amalgamated Exploration Corporation, P. O. Box 3059, Boston, Mass., owners. V. M. Weil, general manager; C. H. Cuneo, superintendent.

Edna Mine (quartz). (See Report XII, p. 92.) It is 4 miles northwest of San Andreas. Shaft 145 feet deep on the property. Idle. J. Stephen White, Monadnock Building, San Francisco, Cal., owner.

Eida Mine (quartz). One mile south of Mountain Ranch, on ridge between El Dorado and Murray creeks. Shaft 85 feet deep. Prospect. Idle. E. C. Rigney, of Eldorado, owner.

Esmeralda Mine (quartz). (See Report VIII, p. 133.) It is located 6 miles southwest of Sheep Ranch, on ridge between Indian and San Antonio creeks. Workings caved. Idle. John F. Davis, 785 Market street, San Francisco, owner.

Etna King Mine (quartz). Located north of the Gold Cliff mine, on the southeast slope of Democrat Hill, at an elevation of 1490 feet. Consists of three patented claims, Seigel, Widow and North End, with area of 46 acres, on the same vein as the Gold Cliff. Work is carried on through a 3-compartment, 4½′ x 13½′ in clear, vertical shaft 240 feet deep. The vein has been drifted on 100-foot level, for a distance of 200 feet, on the 200-foot level for 300 feet. The development work shows a vein with an average width of 12 feet with a strike of northwest and southeast, and dipping 80° NE. Ore hoisted by a single-drum 25 h.p. steam hoist. Development work is driven with air drills, air furnished by 2-drill Rand steam-driven compressor. Two 60 h.p. horizontal boilers, oil used for fuel, furnish steam power for hoist and compressor and pumps.

Mill: 9″ x 15″ Blake crusher, 20 stamps weighing 1000 pounds each, four 4-foot Frue vanners. Mill driven by 50 h.p. motor. Mine and mill shut down, only work being done is in unwatering property, with the intention of resuming operations. Four men are employed. Etna King Mining Company, owners, San Joaquin Valley Bank Building, Stockton, Cal. President, Dr. G. Pache, of Angels; secretary, A. S. Cohn; J. P. Taggart, general manager.

Eureka (Old Henry) Mine (quartz). It is 1½ miles northeast of West Point, on ridge between Mott's Gulch and Skull Flat Gulch. Shaft 135 feet deep. Caved. Idle. J. Rowe and J. Jenkins, of West Point, owners.

Everlasting Mine (quartz). (See Reports X, p. 63; XII, p. 92.) It is 1 mile south of San Andreas, on the Copperopolis road. Shaft 150 feet deep. Caved. Idle. Lowell N. Reynolds, No. 15 Court Square, Boston, Mass., owner.

Excelsior Mine (quartz). It is a prospect 1¼ miles northeast of Mokelumne Hill. There is a 100-foot tunnel. Idle. C. Peek of Mokelumne Hill, owner.

Fellowcraft Mine (quartz). (See our Reports X, p. 149; XI, p. 978; XII, p. 92.) It is situated on the eastern outskirts of San Andreas. A shaft has been sunk to depth of 216 feet at an angle of 54°, and levels run at 50′, 100′ and 200′ depths, and a crosscut run 100 feet in the footwall country rock on 100-foot level. Strike of the vein is N. 18° W., with a dip of 55° E. The equipment on the property consists of single-drum steam hoist, 80 h.p. Park & Lacy horizontal boiler, 10 stamps, weighing 750 pounds per stamp, two 4-foot Frue vanners, 1 Wilfrey table. Mill driven by 50 h.p. Park & Lacy steam engine. Idle. G. Tiscornia Company, of San Andreas, and A. N. Lewis Estate, of San Francisco, owners.

Ferguson Mine (quartz). It is 3 miles east of West Point. Shaft 112 feet deep, caved. Idle. David Porteous, J. P. Porteous, D. Oliver, of West Point, owners.

Fidelity Mine (quartz). Prospect. One mile south of Glencoe, on Cedar Gulch. Shaft 200 feet deep, caved. Idle. John L. Innis, of San Francisco, Cal., owner.

Fine Gold Mine (quartz). (See Report VI, Part II, p. 34.) Situated 4 miles east of Railroad Flat, on ridge southwest of the South Fork of the Mokelumne River. Shaft 260 feet in depth. Idle. James B. Haggin Estate, owner.

Finian Mine (quartz). (See Report XIII, page 104.) It is 4 miles north of Murphy, located in the Washington mining district, on ridge between Indian and San Antonio creeks. Course of vein east and west, dip 75° S. Shaft 200 feet deep. Idle. Willard Mining Company, Boston, Mass., owner.

Finnigan Mine (quartz). (See Report XIII, page 104.) Elevation 1400 feet. Located on the northeast slope of Carson Hill, near the town of Carson Hill. Consists of two claims, Finnigan and Finnigan Extension. The ore body is from 70 to 100 feet wide between walls, with a hard greenstone on the footwall and heavy vein of quartz for hanging-wall. General course of vein is northwest and southeast, dip 70° NE. The mine is worked through a tunnel 300 feet in length and 120 feet below apex of hill. The ore is mined above this tunnel by means of an open cut. Air drills are used in mining and development work, air being supplied by 2-drill Sullivan air compressor, driven by 50 h.p. General Electric Company motor. Ore is free milling, carrying from 1 to 3% pyrite; average value of ore milled is about $2.50 to $3 per ton.

Mill: 9″x12″ Blake crusher, 10 stamps weighing 900 pounds and dropping 6 inches at 108 drops per minute, crushing 4 tons per stamp through 20-mesh wire screen. Inside and outside amalgamation used. Pulp from batteries concentrated on two Gates shaking tables and two 4-foot Frue vanners. Mill driven by 50 h.p. Westinghouse motor. Electric power is furnished by Union Water and Power Company, at a cost of $5 per horsepower. In milling an extraction of 85% is made with a loss of $0.22 in tailings. Concentrates give an average value of $30 per ton, which are shipped to Selby Smelting Company. Total operating costs are $1.90 per ton. T. C. Talbot, Mrs. J. C. Talbot et al., of Carson Hill, owners. T. C. Talbot, manager.

Florence Mine (quartz). It is 4 miles north of Murphy, on south side of Indian creek. Tunnel 150 feet long. Idle. Deserey Frecot, of Sheep Ranch, owner.

Ford Mine (quartz). It is ¼ of a mile east of Mother Lode at San Andreas. A shaft 700 feet deep has been sunk on the vein. The ore bodies have been developed by levels at 100, 200, 300 and 400 feet. The ore zone of this mine may be described as a mineral belt consisting chiefly of chloritic and talcose schist lying upon a quartz schist footwall, and having a hanging-wall of diorite. This belt is about 100 feet wide and within it occurs large lens-like masses of quartz. The ore body contains a variable percentage of pyrite. The vein has a strike of N. 20° W. and dip of 65° E. This vein has numerous small stringers of quartz running into it, and has been reported to have been very rich at intersection of the vein and feeders. The trend of the ore shoot is toward the north. A small prospect shaft has been sunk on a parallel stringer lead 200 feet east of main shaft, and some very rich pockets taken out recently. Main shaft caved and in poor condition.

The equipment on property consists of a steam hoist and small compressor. Two men are at work in new prospect shaft. W. A. Dower and L. Hawes, of San Andreas, owners.

Fricot Group of Mines (quartz). They are located 6 miles southwest of Sheep Ranch, on ridge between San Antonio and O'Neils creeks. Consisting of following claims: Columbus, Rochester, White Pine, New Orleans, Philadelphia, Oswego, Albany, Gov. Davis, Twentieth Century, Horseshoe, Bonanza Placer; total of 179 acres. Series of parallel east and west veins dipping to north, with an average width of 2 feet. Also a series of north and south stringer veins, formation being a mica schist. Numerous shafts have been sunk on these veins with depths of 90 to 150 feet, also tunnels of various lengths from 50 to 430 feet. Albany tunnel is a crosscut tunnel 430 feet long. D. Fricot, of Angels, owner.

Garibaldi Mine (quartz). It is located 3 miles north of Angels. The property has been developed by crosscut tunnel 400 feet in length and a drift north of the vein for a distance of 60 feet. Width of vein over 100 feet composed of heavy white quartz croppings and talcose slates intersected by numerous quartz stringers. Idle. John Seiffert, of San Andreas, owner.

Gerabaldi Mine (quartz). At Glencoe, on ridge northeast of Cedar Gulch. Prospect, two shafts, 40 feet and 60 feet deep. Idle. Bertola Malispieno, of Glencoe, Cal., owner.

Geravanti Mine (quartz). It is 3 miles west of Mokelumne Hill, on ridge south of Mokelumne River. Prospect. Idle. John Geravanti, of Mokelumne Hill, owner.

German Ridge and Jupiter Mines (quartz). (See Report X, page 148.) Located 3 miles northeast of Altaville. Controls two claims and two millsites, Jupiter, Jupiter Millsite, German Ridge, and German Ridge Millsite, consisting of 85 acres. Strike of vein is N. 47° W. with a dip of 70° NE. Crosscut tunnel on property 600 feet in length which gives 700 feet of backs. Extensive superficial developments have been made on the property in search of pockets. Idle. W. H. Steffler Estate, of San Andreas, owner.

Gilbertson Mine (quartz) It is 4 miles northeast of West Point on ridge southeast of Mokelumne River. Tunnel 70 feet long on vein. Shaft 70 feet deep. Idle. Standard Electric Company, San Francisco, Cal., owners.

Ghost Mine (quartz). (See Report XIII, page 105.) It is located $\frac{1}{4}$ of a mile south of Angels. Controls 821 acres. There are two vertical shafts on the property, north shaft being 1350 feet deep and south shaft 350 feet deep, both sunk in the greenstone which is on the footwall of the vein. Crosscuts were driven at 900 and 1350 feet in north shaft, cutting a vein 20 feet in width at a distance of 200 feet from shaft. No further work was done in developing the property. Equipment at north shaft, two 75 h.p. horizontal boilers, 75 h.p. double-drum steam hoist, 2-drill Ingersoll compressor. At south shaft 75 h.p. double-drum hoist. Calaveras Cooperative Mining Company, Bonebrake & Son, J. Drake, of St. Louis, Mo., owners.

Glencoe Mine (quartz). It is 1 mile northwest of Glencoe, on Valentine Gulch. Controls the following claims: Mexican, Sara Queen, Stietzer, Valentine, 80 acres. Sara Queen tunnel 1900 feet in length. Mexican shaft 150 feet deep. No. 1 Valentine tunnel 500 feet, No. 2 Valentine tunnel 500 feet. Width of vein 5 feet, strike due E. & W., dip 60° N.

Mill: 10″x20″ Blake crusher, 20 stamps weighing 850 pounds, 2 Gilpin County shaking tables. Idle. Glencoe Mining Company, 4226 Terrace street, Oakland, Cal., owners; W. C. Childs, president; J. M. Gillespie, secretary.

Gold Cliff Mine (quartz). (See Reports X, pp. 60, 150; and XII, p. 92; M. and S. Press, Nov. 26, 1904.) This property is one of the Utica Mining Company group of mines, and lies just west of Angels Camp. Consists of the following claims: Pilot Nob, Gold Cliff, Madison, Specimen, Fairfax, Excelsior, Peachy, No. 1 and No. 2 Placer Claim. This mine is on a westerly splitoff from the main Mother Lode vein. The ore shoot on the vein has a trend towards the north. The general course of vein is northwest and southeast with a dip of 45° NE. A 3-compartment incline shaft has been sunk from level of old open cut on an incline of 45°, to 1600-foot level, from which point it is sunk on 12° incline to 1800-foot level. The mine is at present being operated from the 1500, 1600, 1700 and 1800-foot levels; mine stoped out above 1500-foot level. The method of mining the ore is by open stope and pillar system, very little timbering being done. Ore hoisted from incline shaft in 4-ton skips by a 225 h.p. double-drum electric hoist.

Mining is done with air drills, air being supplied by 30-drill Laidlaw-Dunn-Gordon compressor, electrically driven. Mine makes a small amount of water, which is handled by a 4-inch seven-stage Dowell pump driven by 75 h.p. motor. Ore trammed from shaft to mill by electric traction.

Mill: 10″x20″ Blake crusher, 40 stamps weighing 1000 pounds per stamp, dropping 7 inches at 104 drops per minute, crushing 5 tons per stamp through 20-mesh wire screen. Battery pulp concentrated on twenty-four 4-foot Frue vanners; 100 h.p. Westinghouse motor drives mill. Electric power furnished by Union Water Company. A saving of 90% is made by amalgamation and concentration. Tailings loss amounts to $0.20 per ton. Concentrates are valued at $30 to $50 per ton. Ninety-six men are employed. F. T. Martin, general manager. Hayward, Hobart and Lane estates, owners, Merchants' Exchange Building, San Francisco.

Gold-Galena Mine (quartz). It is 2 miles northeast of West Point, on ridge southeast of Skull Flat. North shaft 300 feet deep, south shaft 175 feet deep. Idle. John Breuner, Sacramento, owner.

Gold Hill Mine (quartz). Three miles south of Murphy. Shaft 110 feet deep. Three tunnels, 80, 125 and 300 feet in length. Idle. George Taylor, of Murphy, owner.

Gold Hill Mine (quartz). It is located 6 miles south of Angels. Controls 60 acres. Vein has a strike of north and south, dipping 60° E., with a width of ore from 20 to 100 feet. Operated through a 600-foot tunnel, ore mined above tunnel by open cut. Five-stamp mill. 900-pound stamps, two 4-foot Frue vanners. Ten men employed. Martin Voinich & Bros., of Angels, owners. Martin Voinich, superintendent.

Gold King Mine (quartz). It is 8 miles east of Railroad Flat, on Licking Fork of Mokelumne River. Tunnel 214 feet on vein, winze 75 feet deep. Idle. J. T. Jones, of Railroad Flat, owner.

Golden Gate Mine (quartz). Located 1 mile north of San Andreas, on the Mother Lode. Serpentine forms both the footwall and hanging-walls of this lode. To the westward is a broad zone of ankerite with its massive quartz outcrop and characteristic mariposite, and on the eastward of the serpentine is a diabase formation. Incline shaft sunk on a 75° angle on the lode, and ore developed on 200-foot level 400 feet to north; on 300-foot level 350 feet to north. Idle. W. H. Clary, of Stockton, owner.

Good Hope, Sunrise and Calaveras Queen Group of Mines (quartz). Located 4½ miles southeast of West Point, on ridge between the South Fork and Licking Fork of the Mokelumne River. Series of parallel veins cutting slates of the Calaveras formation. The course of veins is north and south, dip 65° E. Workings consist of two tunnels 340 and 120 feet long, and a shaft 100 feet deep. Two men are employed. George J. Porteous, of West Point, owner.

Good Hope Group of Mines (quartz). Located 1 mile north of Glencoe, on San Bruno ridge. Claims: Good Hope, San Bruno, Monte Cristo, Oriental. Porphyry dike on hanging-wall of vein. Strike of vein N. 65° E., dip 60° NW., width 5 feet. Good Hope tunnel 200 feet long, San Bruno tunnel 300 feet in length. Idle. Mrs. G. M. Danielson, of Glencoe, owner.

Gospel Mine (quartz). Three miles northwest of San Andreas. Ore was mined from an open cut to a depth of 20 feet. Idle. Martin Donallan, of San Andreas, owner.

Gottschalk Mine (quartz). It is 1½ miles northwest of San Andreas, between the Calaveras River and Murry Creek, on the main Mother Lode. The main vein consists of a mass of heavy white quartz croppings which have a general course of northwest and southeast. Footwall of vein is a hard black slate and hanging-wall of amphibolite schists. There is series of east and west veins more or less parallel on which most of the development work has been done. Shaft 492 feet deep sunk on one of the east and west veins, and a tunnel 500 feet in length connects with shaft at 192-foot level. On the 100-foot level below tunnel a drift has been driven 200 feet SE. Idle. Mrs. C. V. Gottschalk, 1345 North Joaquin avenue, Stockton, owner.

The Gould Mine (quartz). The property is situated near the town of Carson Hill and controls four claims, Boston, A. P. A., Dirego, and Tariff Reform. General course of vein N. 45° W., dip 65° NE., ore similar in character to Finnigan. Work on property consists of a shaft sunk on the vein 75 feet deep, and a tunnel on vein 250 feet in length. Small amount of development work being prosecuted. Gould Gold Mining Company, owner. J. M. Jordan, of Oakdale, president and manager.

Grasshopper Mine (quartz). It is 4 miles southeast of Vallecito. A 3-foot vein has been opened up by two tunnels, upper tunnel 360 feet in length, giving 440 feet of backs. Lower tunnel 200 feet long, with 640 feet of backs. Porphyry forms both walls of vein. Two men employed driving lower tunnel. A. W. Slatten, of Vallecito, owner.

Gray Mine (quartz). It is 4 miles northeast of West Point, on ridge southeast of the North Fork of the Mokelumne River. Crosscut tunnel 200 feet long, 80 feet above lower tunnel there is a tunnel driven on vein 100 feet in length. Idle. Thomas Porteous, of West Point, owner.

Great Divide Mine (quartz). It is 2½ miles west of Murphy, on ridge between Angels and San Domingo creeks. Two parallel veins running east and west. Shaft 52 feet deep and tunnel 100 feet long. The formation is mica schist. Idle. F. A. Mitchell of Murphy, owner.

Great Western (Right Bower) Mine (quartz). (See our Report XIII, page 117.) It is 4½ miles west of Murphy, on ridge between Indian and San Antonio creeks. Vein 2 feet wide, very base, containing pyrite, zinc blende and galena, in mica schist. Shaft 200 feet deep on vein. Idle. W. Emerson and Bert Del Ray, of San Francisco, owners.

Great Western Mine (quartz). It is 4 miles southwest of Sheep Ranch, on ridge between Indian and San Antonio creeks. Claims are Great Western, Florence, Helena, and Annie Fraction. Total, 73 acres. Vein is 2 feet wide, with a course of N. 55° W., dip 65° NE. Work carried on through three tunnels, upper 175 feet long, middle 280 feet, lower 520 feet in length, which gives 400 feet of backs. The walls are a dark siliceous slate, and the quartz is found intimately associated with a porphyry dike. Three men are employed. H. J. Shepherd, Riley & Sons, 32 Glenn avenue, Oakland, owners; W. D. Riley, of Murphy, agent.

Guiffra Mine (quartz). At Mokelumne Hill, on Stockton Ridge. Shaft 105 feet deep, caved. Ten-stamp mill on property. Idle. John Guiffra of Mokelumne Hill, owner.

View of steel gallows frame at Gwin Mine, Calaveras County.

Gwin Mine (quartz). (See Reports VI, Pt. II, p. 30; X, p. 67; XII, p. 93. Folio 63, U. S. G. S., Mother Lode District.) Located 4 miles southwest of Mokelumne Hill at an elevation of 1040 feet, in a belt of Mariposa slates. The Gwin vein strikes with the slates and is generally parallel with their cleavage. It is accompanied by stringers, and varies in width, but is more of a regular vein than a stringer lead. Formations encountered in sinking the Gwin shaft are diabase tuff, clay slates and small acid dike rocks. Strike of main vein is N. 12° W., with a dip 68° E. which has a soft black slate gouge on footwall, with black slates on hanging-wall. The ore shoots of the main vein are of great length, varying in width from a few inches to 20 feet. The vein is usually of a banded structure and exhibits a branching tendency with many spurs running into the hanging-wall. Main shaft sunk in hanging-wall slates 2400 feet vertical, cutting vein at 1200-foot level, and the footwall of vein at 1245 feet. Winze 450 feet south of main shaft on 2400-foot level, having a depth of 450 feet.

Equipment: 118-foot steel head-frame, three 80 h.p. horizontal boilers, 20″x 36″ double-drum hoist, driven by either steam or water power (2 ten-foot Pelton wheels), waste water from hoist and mill stored in 75,000 gallon tank, from which tank it flowed through one 18″ pipe line and one 15″ pipe line to compressor plant on river, giving a head of 400 feet. Air was furnished by one 2-stage 18″x24″ Rix compressor, one 2-stage 15″x24″ Ingersoll-Rand compressor.

Mill: Two 10″x11″ Blake crushers, 100 stamps, weighing 950 pounds each. Twenty 6-foot Frue vanners, sixteen 4-foot Frue vanners. Mill was driven by water power. Property has been closed down since 1908. Gwin Mine and Development Company, 335 Mills Building, San Francisco, owners; Ansel M. Easton, president; J. J. Hachmann, secretary; Benj. Johnson, of Paloma, agent.

Another view of steel gallows frame at Gwin Mine, Calaveras County.

Hamby Mine (quartz). It is 4 miles southeast of Mokelumne Hill, on the Mokelumne Hill and Valley Springs road. Located on main Mother Lode belt, consists of 131 acres. The property was worked through a vertical shaft 300 feet deep, sunk in country rock. At a depth of 200 feet a crosscut was run 220 feet to cut vein, and the vein drifted on 400′ N. On 300-foot level vein was crosscut 200 feet from shaft and drifted 160′ N., and 125′ S. Course of vein is N. 25° W., with a dip of 70° E., width of orebody developed being from 10′ to 20′, consisting of quartz stringers running through schists with greenstone footwall and heavy gray slate hanging-wall. Property being reopened.

Mine equipment: 65 h.p. horizontal boiler, 50 h.p. double-drum steam hoist.

Mill: 10″x20″ Dodge crusher, driven by 15 h.p. motor, 20 stamps, weighing 1000 pounds each, four 6-foot Frue vanners. Mill driven by 50 h.p. motor. Twenty men employed. McKnight Mining Company, Pittsburg, Pa., owners. L. Everett, superintendent.

Hancock Mine (quartz). Located 2½ miles northwest of Mokelumne Hill, near Middle Bar bridge. A crosscut tunnel cuts vein, which crops out at the roadside a short distance from the mouth of tunnel. C. O. Mitchell, of Mokelumne Hill, owner.

The Hardy Mine (Hardy, McCreight & Reed) (quartz). Located on the north slope of Chaparral Hill, at an elevation of 1400 feet, 3 miles south of Angels. This property consists of two patented claims, Hardy, McCreight & Reed. Work is carried on through a tunnel 360 feet in length, and by winze sunk on vein to a depth of 300 feet. Strike of vein is northwest and southeast, dipping 47° NE. Ore body is a heavy white quartz highly impregnated with pyrite, the hanging-wall being of a soft porphyry and footwall of gray talcose slate. The vein has a width of 5 feet. Very rich pockets have been taken out of this property, these pockets occurring on the contact of quartz and porphyry. Ore free milling with 1 to 5% pyrite.

Mill: 4 stamps weighing 500 pounds to the stamp and dropping 6 inches at 112 drops per minute, crushing 3 tons per stamp through 20-mesh wire screen. Both inside and outside amalgamation used. From sluices the battery pulp runs over one 4-foot Frue vanner. Mill driven by 6 h.p. gasoline engine. Eight men are employed. Property being operated under lease and bond by James G. Maltman. Hayward, Hobart & Lane Estate, owners.

Hercules Mine (quartz). It is 5 miles north of Murphy, on ridge between Indian and San Antonio creeks. Hercules shaft 200 feet deep, on 100-foot level, drift 120 feet north, on 200-foot level, drift 150 feet north. Horseshoe shaft 160 feet deep. Idle. Dr. Hutchinson, of Los Angeles, J. Staples, of Murphy, owners.

Holland Mine (quartz). Located 1½ miles south of San Andreas, on Copperopolis road. Vein on contact of diabase on footwall, and talcose slate on hanging-wall. A crosscut tunnel 500 feet in length has developed a vein 16 feet in width, which gives 125 feet of backs. Idle. J. F. Holland, of San Andreas, owner.

Holmes Mine (quartz). It is 2 miles northwest of Glencoe, on ridge south of the South Fork of Mokelumne River. In granodiorite formation. Tunnel 375 feet long, width of vein 3 feet, strike N. 20° W., dip 50° W. Idle. Walter Holmes, of Valley Springs, owner.

Homestake (*Dora*) *Mine* (quartz). (See Report XII, page 92; XIII, page 102.) It is 3 miles north of Murphy. Two tunnels on vein, each about 200 feet long, shaft 75 feet deep. Vein 12 inches wide, occurs in a mica schist. Dora Mining Company, owners. Levi Samuels, of San Francisco, president.

Homestake Mine (quartz). It is 7 miles east of Murphy, on slope of Stanislaus Canyon. Three tunnels on vein, the lower tunnel 300 feet long and over 400 feet of drifting on vein. Vein is a dark quartz containing free gold, pyrite, zinc and galena. Idle. Mrs. I. T. Collier, of Murphy, owner.

Hudson and North Branch Mines (quartz). Are located 2½ miles northwest of San Andreas, on ridge northwest of the North Fork of Calaveras River. The vein occurs in the black clay slates with a strike of northwest and southeast. This system of veins lies to the west of the main Mother Lode. There is a shaft 300 feet deep on Hudson claim, and 100-foot shaft on North Branch. Idle. Mrs. A. Machiavella, of San Francisco, owner. Frank Solinsky, Monadnock Building, San Francisco, agent.

Idaho Consolidated Mines (quartz). They are 6 miles southwest of Sheep Ranch, on ridge between San Antonio and O'Neils creeks. Consisting of the following claims: Idaho, Grace Darling, Frontenac; total of 61 acres. These properties join the Fricot group, are similar in character as regards veins and formation. Frontenac tunnel 300 feet long. Grace Darling tunnel 172 feet in length. D. Fricot and Moore Bros., of Angels, owners.

Idora Mine (quartz). Two miles northeast of Mokelumne Hill, consisting of the following claims: Gushing Spring, St. Patrick, Idora, Big Fraction, and Fraction. Two series of parallel veins on property having north-south and east-west courses. They are prospects with only superficial development. W. T. Robinson, of Mokelumne Hill, owner.

Illinois Mine (quartz). It is located 7 miles south of San Andreas, on Copperopolis road, near Demarest mine. An incline shaft has been sunk to a depth of 200 feet and two levels opened. There are two veins, one running N. 5° E. and the other N. 30° W., converging northward. The formation is clay slate on the footwall and amphibolite schist on the hanging-wall. Idle. B. K. Thorn Estate, of San Andreas, owners.

Iron Rock Mine (quartz). (See Report XIII, page 109.) Situated on north slope of Carson Hill, and 4 miles south of Angels. Controls two claims, Iron Rock and Relief. Work was carried on through a tunnel 600 feet in length and 150 feet below apex of hill. Idle. Last work was in 1880. Frank Solinsky, Monadnock Building, San Francisco, Raggio Bros., of Angels, owners.

Isabel Mine (quartz). It is ½ mile west of Vallecito, on Red Hill. Shaft 75 feet deep. William Harfst of Vallecito, owner.

Jackson Mine (quartz). It is located 3 miles northwest of San Andreas on the North Branch and Valley Springs wagon road. The strike of vein is northwest and southeast, dip 70° NE. Vein is in black clay slates. Has produced some very rich pockets on intersection of this vein with east and west stringer leads. There is a series of shafts and tunnels 200 feet in length on these east and west veins. Two men are at work prospecting for pockets. John Jackson, of North Branch, owner.

The Jones Mine (quartz). Three miles south of Angels, shaft 600 feet deep, sunk on vein. This shaft is now caved, and all machinery has been removed. Ore reported very base, containing zinc and tellurides of gold and silver. Idle. D. B. Demarest, W. Garland, and R. A. Perano, of Angels, owners.

Josephine Mine (quartz). Prospect 2½ miles southwest of Railroad Flat. Shaft 50 feet deep. Idle. Paul Belisle, of Railroad Flat, owner.

Jumper (*Rose Rock*) *Mine* (quartz). (See Report XIII, page 117). It is 4½ miles north of Murphy, on ridge north of San Domingo Creek. Two tunnels driven on vein, upper tunnel 150 feet long, lower tunnel 230 feet in length. Idle. G. Goodwin, of Santa Cruz, owner.

K. & J. Mine (quartz). It is at Esmeralda, on ridge between San Antonio and Indian creeks. Shaft 100 feet deep, and tunnels 150 feet long. Idle. D. D. Demarest and E. J. Moore Estate, Angels, owners.

Keltz Mine (quartz). Situated 4½ miles northeast of West Point, on ridge south of North Fork of Mokelumne River. In granite. Five tunnels on property, all caved. Idle. Walter Morgan, Chas. Morgan, of San Francisco, owners.

Kenross Mine (hydraulic and quartz). It is 9 miles east of Mokelumne Hill, on ridge west of Esperanza Creek. Controls 320 acres of land. Idle. Kenross Mining Company, 1776 N. Hancock street, Meadville, Pa., owner.

Kentucky House Mine (quartz). It is located 3 miles south of San Andreas, on ridge between the juncture of Calaveritas Creek and South Fork of Calaveras River. Shaft 160 feet deep. Caved, and no work has been done on the property for years. Idle. J. C. Seiffert of Kentucky House, owner.

Kidoo Mine (quartz). Situated on the ridge between Indian and San Domingo creeks, about 2 miles south of Sheep Ranch. Comprises five claims: Edward, Nonie, Kidoo, Lemon, Peal. Shaft 50 feet deep. Two men employed. E. J. Bumstead, of Murphy, owner.

Lamphyre Mine (quartz). It is 1 mile south of Mokelumne Hill, on ridge east of Chile Gulch. Incline shaft 270 feet, vertical shaft 50 feet. Width of vein 8 feet, course N. 30° E., dip 60° E. Idle. F. A. West, of Stockton, G. P. Sperry, of Redwood City, owners.

Last Chance Mine (quartz). It is 2 miles west of Murphy, on ridge between Angels and San Domingo creeks. Shaft 130 feet deep. Idle. F. A. Mitchell, of Murphy, owner.

Last Chance Mine (quartz). It is located southeast of Utica mine, controlling 38 acres. Two shafts on the property, one 70 feet deep and the other 320 feet deep. Idle. Charles Tryon Estate, owners. Charles Tryon, Jr., agent.

Legal Tender Mine (quartz). (See Report XIII, page 110.) It is 5 miles north of Murphy, on ridge between Indian and San Antonio creeks. Strike of vein east and west, dip 80° S. Crosscut tunnel 147 feet long, vein drifted on 340 feet. Shaft 110 feet deep connects with tunnel. Two men employed. George Taylor, of Murphy, owner.

Lightner and Angels Mills, Angels Camp, Calaveras County, California.

Lightner Mine (quartz). (See our Report XIII, page 110; M. and S. P., November 26, 1904.) Is a fractional claim adjoining the Utica and Angels mines, on which a shaft has been sunk to a depth of 900 feet. The ore body has been opened up on 200, 300, 400, 500, 600 and 900-foot levels, all of which have been driven to end lines except 900-foot level, which has been drifted south 40 feet. The ore body is similar in character to Utica, consisting of amphibolite schists and gray slates above the 600-foot level. On the fourth, fifth, and sixth levels this ore body is 120 feet wide. On the lower levels ore body has a hard diorite footwall and diabase hanging-wall. Between 500 and 600-foot levels the ore is cut off by a zone of talc 15 to 20 feet thick with a dip of 30° NE. From the 600-foot level a winze has been sunk to the

900-foot level and a crosscut run which cut the ore body below this talc zone; the dip of the ore body was found at this point to be vertical, previous dip of ore body above the talc zone being 65° E. The vein on sixth level at 100 feet north of shaft splits into three veins with a barren zone of schists between.

Ore hoisted in 3-ton skips by double-drum electric hoist driven by 200 h.p. motor, from a 3-compartment vertical shaft (7′ x 16′ in clear) and dumped over grizzly, then to 10″ x 20″ Blake crusher, driven by 20 h.p. motor. There is a 500-ton storage bin under crusher. From shaft to mill bins the ore is hoisted in 3-ton cars over 30° incline, the hoist being a friction hoist run from line shaft of mill. Air drills are used in mining and development work. Air is supplied by a Rand compressor driven by 150 h.p. motor. Timber framer driven by 25 h.p. motor and a rip saw by 50 h.p. motor.

Mill: 60 stamps, weighing 900 pounds per stamp, dropping 7 inches at 104 drops per minute, crushing 5 tons per stamp through No. 1 tin screen. Battery pulp concentrated on thirty-six 4-foot Frue vanners, one half of gold values recovered by amalgamation inside of batteries, one fourth on outside plates, one fourth by concentration. An extraction of 90% is made. Loss in tailings 20¢ per ton. One 100 h.p. motor runs 40 stamps of mill, and a second 100 h.p. motor runs 20 stamps, tram, and concentrators. Total operating costs are $2.25 per ton. Timber costs 1⅛c per running foot. Lumber $18 per 1000 feet. Sulphurets run from $50 to $100 per ton and shipped to Selby Smelting Company. Freight rates from Angels to smelter are $4.75 per ton. Sixty-seven men are employed. Lightner Gold Mining Company, owner. President, C. M. Jackson, of Stockton; secretary, B. F. Wellington, of Stockton; Alexander Chalmers, general manager.

Lindsay Mine (quartz). It is ½ mile south of Altaville. Prospect. Idle. Prince, Bertha Peachy Estates, of Altaville, Owners.

Little Hero Mine (quartz). It is 1½ miles northeast of El Dorado, on ridge southeast of Corral Gulch. Shaft 80 feet deep and tunnel 80 feet in length. Idle. John Raggio, of Stockton, Cal., owner.

Live Oak No. 1 and No. 2 Mine (quartz). One mile east of Mountain Ranch, on ridge north of Corral Gulch. Shaft 150 feet deep and tunnel 200 feet in length. G. Tiscornia and L. Cadmartori, of San Andreas, owners.

Lockwood Mine (quartz). (See our Report VIII, page 138.) Located 3 miles east of West Point, on ridge east of Bear Creek. Claims: Lockwood, East Lockwood, West Lockwood. Width of vein three feet, strike N. 23° W., dip 80° SW. The vein is opened by three shafts; north shaft 430 feet, middle shaft 160 feet, and south shaft 165 feet in depth. Work is at present being carried on in sinking north shaft. On 68-foot level drift N. 52′, S. 160′. On the 124-foot level drift N. 6′, S. 485′. On the 176-foot level drift N. 80′, S. 230′. On 230-foot level drift N. 140′ and S. 202′. On 325-foot level drift N. 325′ and S. 120′. Vein faulted north of north shaft 40 feet to the west. North of the shaft a series of diorite dikes cut the vein at right angles and have a dip of 70° S. South of the shaft a series of diorite dikes cut diagonally across the vein, having a dip of 70° S. The dikes have made no difference in the character of the ore, which is the same on each side. The dikes are of later origin than the vein. Numerous shear zones are noticed, having a course of N. 13° W., and it appears that where these shear zones come in contact with the vein an ore shoot is formed. The vein pinches and swells, wedge-shaped quartz forming on footwall and gradually widening to 2 or 3 feet and cutting across the fissure at a low angle to the hanging-wall, where it will pinch out.

There are two well defined shoots of ore, one north of shaft, the other south of shaft. Former 150 feet long with an average width of 2 feet, latter 100 feet long, having an average width of 18 inches. Both walls are granodiorite, the footwall being well defined while the hanging-wall is more or less fractured. The vein quartz is usually a vitreous bluish black variety. The ore is a heavy sulphide in character, consisting of pyrite, marcasite, pyrrhotite, galena, and sphalerite. Ore runs from $12 to $200 per ton.

Equipment: One 65 h.p. boiler, 6″ x 8″ single-drum hoist, 10″ x 10″ Ingersoll-Rand compressor. A 6″ x 4″ x 6″ Worthington pump lifts water from 330-foot level to 230-foot level, from which point it is pumped to surface by 7½″ x 5″ x 6″ Worthington pump, 18,000 gallons of water being handled in twenty-four hours. Shaft sinking cost $40 per foot. Drifting $15 per foot. Sinking operations are carried on with Jackhammer drills.

Company proposes to install a plant for treatment of the ore, similar to Black Oak mine in Tuolumne County. Fifteen men employed. This property is being developed on an extensive scale, no stoping is being done. Union Development Company, 713 Iowa Loan and Trust Building, Des Moines, Iowa, owner. W. O. Pray, general manager.

Lone Star (*Reed and Hillary*) *Mine* (quartz). Located 2½ miles northwest of West Point, on the North Fork of the Mokelumne River. Series of parallel veins in granodiorite formation, having a course of northwest and southeast, with a dip of 75° SW. Series of ore shoots from 100 to 320 feet in length, with an average width of 2 feet. Property developed by the following system of tunnels:

Tunnel No. 1	300′ length;	125 feet below outcrop
Tunnel No. 2	280′ length;	196 feet below outcrop
Tunnel No. 3	380′ length;	301 feet below outcrop
Tunnel No. 4	1,200′ length;	358 feet below outcrop
Tunnel No. 5	850′ length;	468 feet below outcrop

Shaft 300 feet deep sunk below No. 5 tunnel level. On Reed & Hillary claim:

Tunnel No. 1	360′ length; 160 feet below outcrop
Tunnel No. 2	550′ length; 226 feet below outcrop
Tunnel No. 3	700′ length; 336 feet below outcrop
Tunnel No. 4	800′ length; 446 feet below outcrop

Property Idle. Buildings and machinery in poor condition. J. H. Purdy, of Los Angeles, owner.

Lopez Mine (quartz). Near Esmeralda, on ridge north of San Antonio Creek. Shaft sunk on vein to depth of 180 feet. Idle. Jesus Lopez, of Esmeralda, owner.

Lucky Boy Mine (quartz). It is located 4 miles south of San Andreas, on the San Andreas and Copperopolis road. Vein occurs on contact of serpentine and schists. Shaft 105 feet deep on vein. Boiler and single drum steam hoist on property. Idle. James Waters, of San Andreas, owner.

Main and Fort Ritter Mines (quartz). It is 4 miles north of Mountain Ranch, on ridge north of Murray Creek. Prospect. Idle. C. F. Walters, M. Voorhies, of San Andreas, owners.

Maloney Mine (quartz). At Mokelumne Hill, on ridge south of Mokelumne River. Prospect. Idle. Mrs. Ella Maloney, of Mokelumne Hill, owner.

Mammoth and Jumper Mines (quartz). Two miles northeast of Mokelumne Hill, consisting of the following claims: Jumper, Mammoth, Challenge, Wabash, Midway. Series of north-south and east-west veins. Formation granodiorite and slate. Prospects with only superficial development. W. T. Robinson, S. L. Davidson et al., of Mokelumne Hill, owners.

Martha Mine (quartz). It is 4 miles northeast of El Dorado, on Murray Creek. Shaft 52 feet deep sunk on vein 3 feet wide with a course of N. 30° W. Idle. C. B. Coulter, of Mountain Ranch, owner.

Mascot Mine (quartz). Five miles east of Murphy, on Bald Mountain. Vein 2 feet wide, strike E. and W., dip 40° N. Tunnel 225 feet long. Shaft 85 feet deep. Idle. George Taylor, of Murphy, owner.

May Day Mine (quartz). It is 1 mile west of Murphy, on ridge between Angels Creek and French Gulch. Controls the following claims: May Day, Wide West, May Day Extension, Wide West Extension, Goldberg. Four parallel veins having an east and west course and dipping from 50° to 75° S. Crosscut tunnel 2000 feet long cutting all four veins. Series of prospect shafts on vein. Two men are employed. E. P. Heald, Healds Business College, San Francisco, owner.

Mayflower (*Banner*) *Mine* (quartz). (See Report XII, page 95.) It is 1 mile west of Murphy. There are two parallel veins. The formation is mica schist and quartzite. Veins strike nearly east and west and dip 85° N. Two shafts sunk on veins about 600 feet apart. East shaft 150 feet deep, west shaft 165 feet deep. East shaft in good condition, west shaft caved. Idle. W. Brady Estate, owners. Chas. A. Shertliff, trustee, 315 Laurel street, San Francisco.

The Melones Mine (quartz). (M. and S. P., Vol. XXXVI, pages 49 and 52.) It is located on Carson Hill and consists of sixteen claims, containing a total of 151.6 acres extending from the summit of Carson Hill to the Stanislaus River. This property has been under steady operation since 1898, the first 60 stamps of the 100-stamp mill having been installed in 1901. Included in this group of claims is the Stanislaus, which has yielded several varieties of telluride ores, including calaverite and melonite, which were first described from here.

Melones Dam on the Stanislaus River and portion of flume, capacity 5000 miner's inches. Dam is four miles above mill. Melones Mining Company. Photo by W. W. Bradley.

The general course of the vein is northwest and southeast with a dip of 70° NE., but at the 1350-foot level the vein flattens to 50°. This ore body has been opened up by a series of tunnels; the upper tunnel is 250 feet below the outcrop of vein, and is termed the 250-foot level; 875-foot level is also called South Carolina tunnel. The 1100-foot level or main working tunnel, size 7′x9′, is double tracked, and 5000 feet in length, cutting vein at 4000 feet from the mouth of tunnel. At this point a 3-compartment shaft, 5′x17′ in clear, has been sunk on the vein on an incline of 70° to the 1350-foot level; below the 1350-foot level the shaft continues on 50° incline as the vein has flattened at this point.

The amount of working drifts on each level, including adits, is as follows:

250-foot level	1,080 feet
450-foot level	810 feet
590-foot level	960 feet
875-foot level	3,030 feet
1,100-foot level	7,800 feet
1,350-foot level	500 feet
1,600-foot level	300 feet
1,750-foot level	150 feet

Making a total of 14,630 feet. Above the 1100-foot level the ore is being mined by means of the Glory Hole system, and worked below this level by shrinkage stope method, using a system of footwall crosscuts for opening up the ore body; the ore chutes under these stopes are a distance of 40 feet apart. The mill is run on ore from Glory Hole during the dry months of the year, and from stopes during the wet months. Ore trammed to mill from this tunnel by nine 8-ton cars hauled by direct current 500-volt locomotive.

Penstock and 6-foot redwood pipe line. Melones Mining Company. Photo by W. W. Bradley.

Rock hoisted from shaft by double-drum electric hoist, driven by 250 h.p., 220-volt induction motor, hoisting 3½-ton skips at the rate of 1000 feet per minute.

Air drills are used in mining and development work. Air for drills is furnished by a Laidlaw-Dunn-Gordon (22″x24″) (14″x24″) 2-stage compressor. Mine makes only a small amount of water, which is hoisted in water skips.

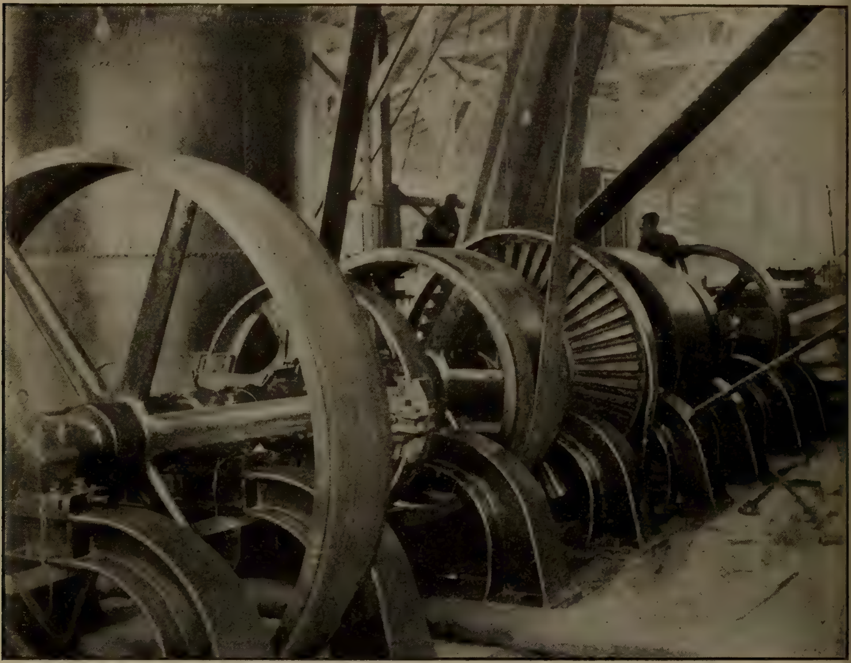
Mill: Ore crushed by two 5 D Gates gyratory breakers to two-inch size; from gravity crushers the ore is conveyed by 12-inch conveyor belt which distributes the ore onto a traveling Robins 24-inch automatic belt conveyor that discharges the ore at different intervals to bin of 1000 tons capacity. Ore from bins fed by Challenge ore feeders to 100 stamps, weighing 1050 pounds each, and dropping seven inches at 102 drops per minute, crushing 5 tons per stamp through 20-mesh screen; outside amalgamation used. The battery pulp from sluices to classifying cones, and concentrated on 27 Wilfrey tables, thirteen 4-foot Frue vanners, seven 6-foot Frue vanners, middlings elevated and reclassified and reconcentrated. Concentrates from tables and vanners are elevated to launders, where it flows to a 20-ton cyanide plant, capacity 600 tons per month. Value of concentrates is from $30 to $50 per ton.

100-stamp mill of Melones Mining Company, Melones, Calaveras County, California. Photo by W. W. Bradley.

Mill is run by water power, water supplied from Melones Mining Company dam on the Stanislaus River, and carried to mine through four miles of flume and through one thousand feet of pipe and tunnel. Capacity 5000 miner's inches. From end of flume the water is carried under mill in a 6-foot redwood stave pipe, 726.45 feet in length.

Additional electric power furnished by Sierra and San Francisco Power Company at a cost of $5.37 per h.p. Value of ore milled is from $2 to $2.50 per ton. Extraction of 83%, loss in tailings being about $0.25 per ton. Cyanide plant makes an extraction of 92% on sulphurets.

Total operating cost is $1.60 per ton. At present writing the mill is being overhauled, concrete foundations built under the batteries and the number of stamps increased to 120. The future plan will be to pay more attention to classification of products, with the idea of increasing the efficiency of the plant. Melones Mining Company, office 131 State street, Boston, Mass.; William G. Devereux, manager; T. A. Fulton, superintendent.



Main power shaft in mill of Melones Mining Company, Melones, Calaveras County, California. Photo by W. W. Bradley.

Mester Mine (quartz). It is located 3 miles northwest of San Andreas, joins the Hudson mine on northwest and the Jackson on southeast, and lies on the same system of veins. Idle. Mrs. Mester of Oakland, owner. Frank Solinsky, Monadnock Building, San Francisco, Cal., agent.

Mexican Mine (quartz). It is 1½ miles southeast of West Point, on Bummerville Ridge. Shaft 100 feet deep. Two men employed sinking shaft. F. Patterson, of West Point, owner.

Mina Rico Mine (quartz). It is 3 miles southeast of West Point, adjoining the Lockwood Mine on southwest. Three shafts, No. 1, 240 feet; No. 2, 112 feet; No. 3, 87 feet, sunk on vein. Idle. J. P. Peterson, Los Angeles, owner.

Minnie Mine (quartz). It is ½ mile north of Glencoe, on ridge north of Mosquito Gulch. Prospect. Four-stamp mill on property. Idle. Mineral Mining and Milling Company, Ira Longanecker, president, M. O'Callaham, secretary, Glencoe, Cal., owners.

Mitchell Mine (quartz). Prospect 3 miles southwest of Railroad Flat, on ridge south of Nelson's Gulch. Tunnel driven on vein 160 feet south. Shaft 60 feet deep. Idle. John Tone, of Stockton, John Gnecco, of Jesus Maria, owners.

Mohawk (*Keystone*) *Mine* (quartz). It is ¼ mile south of Railroad Flat. Developments consist of an incline shaft 260 feet deep, with three levels, 50, 100, 200-foot. Formation is black slate. Vein has an average width of 12 inches; strike N. 30° E., dip 45° E. Series of parallel porphyry dikes cut vein and form a zone of enrichment where they intersect the vein. Property being reopened. Two men employed retimbering shaft. J. F. Buyck, of Railroad Flat, owner.

Montana Mine (quartz). It is 4 miles west of El Dorado, on ridge north of Salamanda Gulch. Controls 30 acres. Vein with an average width of 2 feet opened up by two tunnels, upper tunnel 100 feet below outcrop is 170 feet long. Lower tunnel 600 feet long is 260 feet below apex of hill. Strike of vein is N. and S., dip 55° E. There are over 500 feet of raises and winzes on vein, and 400 feet of crosscuts. Four men employed driving lower tunnel to tap ore shoot which has a trend of 45° north, and was 100 feet long on upper tunnel. This pay shoot makes on contact of quartz vein with a porphyry dike. Two-stamp mill on property. Scossa Bros., of El Dorado, owners.

Monte Cristo Group of Mines (quartz). Located 6 miles north of West Point, on ridge south of the North Fork of the Mokelumne River. Series of parallel veins having a course of north and south with a dip of 80° W. Developments consist of a series of tunnels driven on veins. Idle. E. Sanderson Smith, of West Point, owner.

The Morgan Mine (quartz). (See our Reports IX, p. 37; X, p. 59.) Situated on northeast slope at Carson Hill, 4 miles south of Angels. The property consists of three patented claims, Morgan, Kentucky, Union. General course of vein is northwest and southeast with dip of 55° NE. The croppings of vein consist of a great vein of quartz from 60 feet to 100 feet in thickness, carrying a high percentage in pyrite. Ore is free milling. The ore was mined through a crosscut tunnel 900 feet in length. On this level 400 feet of drifting has been done on the vein. From the tunnel level a winze has been sunk on the vein to a depth of 400 feet. This mine has been idle since 1898. It was from this mine that the famous $300,000 pocket was taken, which included the largest single piece of quartz gold in the world ever taken out of the ground. It is described as resembling in shape the limb of a tree about 5 inches in diameter and 4 feet or 5 feet long. It is stated that in the early fifties the owners pounded out with a hand mortar and pestle, gold valued at $3,000,000 from pockets in this mine. Estate of James K. Fair, San Francisco, Cal., owner.

Moser Mine (quartz). It is 2 miles south of Mokelumne Hill, on Chili Gulch. Shaft 165 feet deep, on 430-foot level drift north 400 feet, south 410 feet; 495-foot level drift north 612 feet, south 800 feet; 595-foot level drift north 300 feet south 200 feet. Width of vein 5 feet, course N 30° E., dip 60° E. Footwall diabase, hanging-wall slate. Idle. S. S. Moser, of Mokelumne Hill, owner.

Mountain King Mine (quartz). It is 3 miles northwest of Copperopolis, adjoining the Royal group of mines on the northwest. An incline shaft has been sunk 500 feet on vein, which has an average width of 5 feet. Strike N. 60° W., dip 32° NE. Vein developed on 100, 200, 250, 400, 500-foot levels. Ten-stamp mill on property. Being reopened. R. P. Parks, Thomas Lockhard, Record Building, Stockton, owners.

Mountain View Mine (quartz). Prospect, 1 mile south of Glencoe, on Woodcock ranch. Shaft 125 feet deep. In slates of Calaveras formation. Width of vein 4 feet. Strike N. 30° W., dip 65° NE. Idle. J. B. Woodcock, T. B. Woodcock of Glencoe, owners.

Mount Nebo Mine (quartz). (See Report XIII, p. 114). It is ½ mile west of Vallecito, on Red Hill. Vein strikes east and west, dipping 80° S. Width of vein being 12 inches with slate footwall and granite hanging-wall. Shaft 70 feet deep. Idle. Mrs. C. T. Hamilton, of Bakersfield, owner.

Mount Timolus Mine (quartz). It is 5 miles northwest of El Dorado, on ridge south of Salamanda Gulch. Vein 2 feet wide, with a strike of N. 75° E., dip 70° S. Shaft 300 feet deep, caved. New shaft being sunk on cross vein, present depth being 85 feet. Equipment consists of 9″x16″ rock breaker, 10-stamp mill. Four men employed sinking new shaft. Mount Timolus Mining Company, owner. J. A. Jack, president; Chas. Pomeroy, secretary; J. A. Jack, of El Dorado, manager.

Nelson Mine (quartz). It is 2 miles south of West Point, on an east and west vein with a dip of 80° S., in granodiorite. Series of shafts sunk on vein from 50 to 100 feet in depth. Two men employed. J. P. Nelson, of West Point, owner.

New York Mine (quartz). It is situated 1½ miles east of Railroad Flat, on New York Hill. Course of vein north and south, dip 75° E., in black siliceous slate formation. Shaft has a depth of 140 feet. Idle. J. Dalzell Brown, of San Francisco, owner.

Nixon Mine (quartz). It is 1 mile northeast of West Point. Two shafts on property, depths 185 and 150 feet. Idle. Mrs. M. A. Nixon of West Point, owner.

North Star Mine (quartz). Located 1 mile west of Angels, on a westerly branch of the main Mother Lode vein. Controls 46 acres of ground, including two mining claims called North Star and Yellow Metal. Strike of vein east and west, with an average width of 15 feet, dipping 60° to the north. Work is carried on through 3-compartment shaft (sunk on a 60° incline, 4′x15′ in clear, to depth of 480 feet). Head-frame 65 feet in height, containing ore bins and 10″x20″ Blake crusher driven by 30 h.p. motor. Ore hoisted in 1-ton skips by double-drum electric hoist driven by 100 h.p. motor. Mining and development work done with air drills, air supplied by 12 drill, belt driven, Sullivan compressor, driven by 100 h.p. motor.

Mill: 40 stamps, 1000 pounds per stamp; sixteen 4-foot Frue vanners driven by 50 h.p. motor. Property shut down, the only work being done is bailing water. Two men are employed hoisting water, company planning to resume operations in the spring. Dolling Gold Mining Company of Angels, owners. D. G. Overall, president, C. S. Berry, secretary.

North Star (Sawyer) Mine (quartz). A prospect, 2 miles east of West Point, on ridge east of Bear Creek. Shaft 60 feet deep. Idle. J. A. Gouldson of West Point, owner.

North Star (Zacatera) Mine (quartz). It is 2½ miles northeast of West Point, on ridge southeast of Skull Flat Gulch. Crosscut tunnel 400 feet long connects with shaft 340 feet deep. Five-stamp mill on property. Idle. Thomas Porteous, of West Point, owner.

Norwich Mine (quartz). It is ½ mile southwest of Glencoe. Shaft 200 feet deep. Idle. S. L. Davidson of Mokelumne Hill, owner.

Novella (Chino) Mine (quartz). It is 2 miles southeast of West Point, on ridge southeast of Soap Root Gulch. Shaft 112 feet deep. Idle. Frank Novello Estate, of West Point, owners.

Ohio Mine (quartz). It is 3½ miles north of Murphy, on Indian Creek. Two tunnels, upper tunnel 125 feet long, and lower 400 feet long, also a shaft 300 feet deep. Idle. George Taylor, of Murphy, owner.

Old McKinney Mine (quartz). It is 5 miles southeast of Mountain Ranch, on McKinney Creek. Shaft and workings caved. Domeghini Bros., of Mountain Ranch, owners.

Old Washington Mine (quartz). It is 6 miles northeast of Murphy, on San Antonio creek. Controls 40 acres. Two veins are exposed on surface. Washington vein has an east and west course, dip 75° N. Mammoth vein strikes northwest and southeast, dip 60° NE. Width of veins being 6 to 10 feet. Shaft 100 feet deep, on Washington vein. Formation is a siliceous slate. Idle. East Belt Development Company, 341 Thirteenth street, Oakland, owners. J. A. Campbell, of Murphy, superintendent.

Oriole Mine (quartz). Located 1 mile southwest of Angels. Shaft sunk on a vein called the Dead-Horse lead, to a depth of 850 feet, and levels run on vein at 100′, 200′, 300′, 400′, 500′, 600′ and 800′. Machinery dismantled and sold. Idle. Gould Mining Company, owner. A. S. Spool of Valley Springs, president, J. M. Jordan, of Oakdale, secretary.

Oromiento (*Calaveras*) *Mine* (quartz). (See Report XIII, p. 115.) It is 4 miles north of Murphy, on the Sheep Ranch road. Course of vein is N. 70° E., with a dip of 70° S. Shaft 500 feet deep sunk on a vein 2 feet wide of ribbon quartz containing pyrite, zincblende and galena and free gold. Idle. F. Horswill, of Oakland, owner. W. F. Oslin, of Calaveras, agent.

Oro-Plata Mine (quartz). (See Report VI, Part II, pp. 35–42.) It is at Murphy, controlling 120 acres, course of veins, N. 88° W., dip 75° S. Width of veins from 2 to 5 feet. Ore shoots have a trend of 50° E. Veins occur on contact of limestone and Calaveras slates, also along a porphyry dike. Work was carried on through two shafts, depths being 286 feet and 110 feet. The character of the ore is base, containing free gold, with zincblende and galena. Three veins on property, Bay Rock, Oro y Plata, Red Wing. Both shafts are full of water, 110-foot shaft caved. Idle. Willard Mining Company, Boston, Mass., owners; W. C. Hunneman, agent.

Paragon Group of Mines (quartz). They are 3 miles southeast of West Point, on ridge south of the Licking Fork of the Mokelumne River. Claims: Excelsior, Hidden Cave, Reliable. Excelsior tunnel 400 feet long, Hidden Cave tunnel 100 feet long, Reliable tunnel 400 feet long. In slates of the Calaveras formation. Series of parallel veins with a course of N. 10° W., dip 75° W., width of veins from 2 to 6 feet. Two men employed. J. L. Haley, of West Point, owner.

Peek Ranch Mine (quartz). Located 2 miles northeast of Mokelumne Hill. Controls 280 acres under agricultural patent. There are series of north-south and east-west veins on the property. A tunnel 950 feet long has been driven on a north and south vein, which gives 500 feet of backs. Vein has a dip of 45° E., having a footwall of granodiorite and a hanging-wall of slate. Width of vein from 6 to 20 feet. W. T. Robinson, of Mokelumne Hill, agent.

Petticoat Mine (quartz). At Railroad Flat. Vein 2 to 7 feet in width. Strike N. 15° W., dip 65° NE. Vein of ribbon quartz with 2 per cent pyrite, having a black slate gouge on footwall. Property developed by two incline shafts. South shaft 680 feet deep and north shaft having a depth of 210 feet, is 1200 feet north of south shaft. Steam hoist and compressor on property. Idle. Louis Rosenfeld, of San Francisco, owner.

Pilot (*Oro Fino*) *Mine* (quartz). Three and one half miles south of Eldorado, on ridge between O'Neils and McKinneys creeks. Shaft

180 feet deep. Steam hoist, compressor and 4-stamp mill on property, Idle. W. B. Swank, of Mountain Ranch, owner.

Pioneer Chief Mine (quartz). (See Report X.) It is 1¼ miles west of San Andreas, on the west or footwall fissure of the Mother Lode. The vein is found at contact of black slate and diabase, the latter on the footwall. Two shafts were sunk on the vein. North shaft 200 feet deep, and a shaft 125 feet deep about 200 feet south of north shaft. Both shafts caved. No data to be obtained in regard to workings. Idle. B. K. Thorn Estate, of San Andreas, owners.

Plymouth Rock Mine (quartz). Located 2 miles northeast of Jenny Lind, on ridge southeast of Calaveras River. Developments consist of a tunnel 362 feet long driven on vein, and an incline shaft 135 feet deep, 10-stamp mill on property. Idle. Mrs. A. L. Lane, of San Francisco, owner.

Price Mine (quartz). It is 5 miles east of West Point, on ridge south of Middle Fork of Mokelumne River. Shaft 60 feet deep. Tunnel 60 feet long. Three men employed driving tunnel. C. E. Price, of West Point, owner.

Prince Mine (quartz). At Altaville. Shaft 440 feet deep sunk on the vein. Equipment consists of 15 h.p. upright boiler, 15 h.p. single-drum steam hoist. Idle. B. R. Prince Estate, of Altaville, owners.

Purdy Group of Mines (quartz). They are situated 6 miles southeast of Valley Springs, on Bear Creek. In the black slates of the Mariposa formation. Idle. H. P. Purdy, W. H. Nelson, of Valley Springs, owners.

Quaker City Mine (quartz). See our Reports VIII, 144, and X, p. 65. It is 4 miles southwest of Mokelumne Hill. Idle. A. Knell, of Mokelumne Hill, agent.

Quartz Glen (Foote & Thompson) Mine. It is near Rich Gulch, 4 miles southwest of Glencoe. Property opened up by three tunnels on vein. Lower tunnel 600 feet long, upper tunnel 275 feet above lower tunnel 900 feet long. On opposite side of Alabama Gulch a third tunnel has been run 850 feet north on vein. Strike of vein is north and south, dip 70° W. Ten-stamp mill on property. Idle. Mrs. Frank Hopkins, of Los Angeles, owner.

Rand (Poorman) Mine (quartz). Located 2 miles east of Glencoe, on ridge south of South Fork of Mokelumne River. Claims: Poorman, Lawson, Ezra Extension. In the slates of the Calaveras formation. Porphyry dike on both walls of vein. Width of vein 3 feet. Strike due north and south, dip 65° W. Work carried on through 65° incline shaft 312 feet deep. On 160-foot level drift 125 feet N. and 90 feet S.; on 250-foot level drift 200 feet N. Sinking shaft and driving drifts north and south. Equipment consists of 60 h.p. boiler, 35 h.p. single-drum hoist and 5-stamp mill. Eleven men employed. Germiah List, president; Ezra Kellar, secretary, 1776 N. Hancock street, Philadelphia, Pa.

Rathgeb Mine (quartz). See Reports VIII, p. 147; X, p. 63. It is 3 miles southeast of San Andreas, on the Angels to San Andreas road. Vein strikes north and south, with a dip of 70° E., and is on contact of black clay slates and amphibolite schists. Shaft 220 feet deep sunk on vein. Idle. Judge Ira H. Reed of San Andreas, owner.

Recompence Mine (quartz). It is 6 miles west of Sheep Ranch, on ridge between San Antonio and O'Neils creeks. Shaft 65 feet deep. Tunnel 165 feet long. C. W. Sanders, of Angels, owner.

Red Gold (*Buckhorn*) *Mine*. (See Report XII, p. 90.) Two miles west of Murphy, on ridge west of Murphy. Controls 76 acres. Three parallel veins are exposed on surface. The formation is mica schist and quartzite with porphyry dike along each vein. General strike east and west, dip 60° to 80° S. Average width of vein being 12 inches. Shaft 300 feet deep and 100′, 200′, and 300-foot levels. Equipment 35 h.p. boiler, 25 h.p. single-drum steam hoist, 6-drill Hendy compressor, run by 50 h.p. General Electric motor.

Mill: 10″ x 12″ Blake crusher, 5 stamps, 900 pounds per stamp. California Buckhorn Gold Mining Company, Ogden, Utah, owners. J. A. Campbell, of Murphy, agent.

Ritter Mine (quartz). It is 2½ miles north of El Dorado, on ridge north of Murray Creek. Controls 77 acres. Vein 1 to 2 feet wide, opened up by tunnel 640 feet long and shaft 200 feet deep. Quartz is a ribbon rock, containing a very small amount of pyrites, ore occurring in kidneys. Both walls are dark siliceous slate. Equipment on property: 20 h.p. steam hoist, 6″ x 8″ Henry rock breaker, 5-stamp mill. Idle. Mechanics Mining Company, Koenig & Kroll Real Estate Company, 444 Eleventh street, Oakland, owners.

Riverside Mine (quartz). (See Report XII, p. 96.) Located 4 miles north of West Point, on ridge south of the North Fork of the Mokelumne River. Carlton tunnel 400 feet long. Riverside tunnel 300 feet long. Lower Carlton tunnel 200 feet in length. Workings caved. Idle. C. E. Cole, of Los Angeles, owner.

Rockingham (*San Pedro*) *Mine* (quartz). At Glencoe. West shaft 190 feet deep, east shaft 150 feet deep, width of vein 2 feet, strike E. and W., dip 45° W. Idle. S. A. Berry, of Glencoe, owner.

Rose Hill (*Rodesina*) *Mine* (quartz). (See Report XI, p. 176.) One mile west of El Dorado, on ridge south of El Dorado Creek. Tunnel 700 feet long and shaft 120 feet deep. Ten-stamp mill on property. Idle. Louis Emery, Jr., Bradford, McKean County, Pa., owner.

Rosella Mine (quartz). Located 6 miles southwest of Copperopolis, on ridge southeast of Buckhorn Gulch. Workings consist of two shafts. South shaft 180 feet, north shaft 280 feet deep. Hoist and 2-stamp mill on property. Idle. Rosella Mining Company, R. L. Gardner, president, R. L. Birdsly, secretary, 865 Vermont street, Oakland, owners.

Royal Consolidated Mines (quartz). (See Report XI, p. 168; Bull. 18, p. 126.) Located in Salt Spring Valley at Hodson, 3 miles northwest of Copperopolis. Controls the following claims: Pine Log, Royal Goodenough, Ant Hill, Emma, Railsplitter, Republic, Royal No. 2 (all patented), having a total area of 160 acres with 4500 feet on the lode. Property was operated extensively from 1895 to 1905, when closed down and no work done until present reopening. The quartz occurs in a series of large lenses in a dike of diabase. There are also numerous quartz stringers and veins which cut the hanging-wall transversely and intersect the main Royal vein, which has a strike of N. 50° W., dip 30° NE. Developments consist of 30° incline shaft 1100 feet deep.

Ore was mined from a Glory Hole above the 900-foot level and all the material above that level was put through the mill. Ore was hoisted in a $3\frac{1}{2}$-ton skip from mine to crushing plant, where broken in a No. $7\frac{1}{2}$ Gates gyratory crusher; raised by 30-inch belt type bucket elevator to a Gates revolving screen 54″ diameter by 50′ length; screened to 1 inch, oversize to two No. 4 Gates gyratory crushers from which crushed product to bins. From bins ore was trammed to mill by 25 h.p. electric motor in five 5-ton cars. Crushers, elevators and screen driven by 150 h.p. motor.

Mine equipment: One 80 h.p. boiler, two 150 h.p. boilers, 1500 cubic foot Ingersoll-Sargent compressor, driven by 100 h.p. motor.

Mill: 120 stamps, weighing 1150 pounds, 20 stamps to each section and each 20 stamps being driven by 50 h.p. motor; 24 Standard concentrators on first floor, driven by 30 h.p. motor; 6 Wilfrey tables and 6 Johnston vanners on second floor, driven by 30 h.p. motor. Mill and machinery in good condition. Ore reported to have milled $3.72 per ton. Recently purchased by S. M. Page, of Boston, Mass. Pumping out mine to resume operations. H. F. Gendar, superintendent.

Salvador Mine (quartz). It is 4 miles northeast of Jesus Maria, on ridge south of the North Fork of Calaveras River. In limestone formation. Width of vein 5 feet, strike due N. & S., dip 75° E. Lower tunnel 1000 feet long on vein. One hundred feet above lower tunnel there is a tunnel driven on vein 500 feet in length. Eight-stamp mill on property. Idle. T. H. Rooney, of San Francisco, owner.

San Andreas Mine (quartz). It is located ½ mile southeast of the town of San Andreas. On this property there has been sunk numerous prospect shafts in hunting for pockets. There are a large number of parallel and cross veins on the property cutting through the greenstone schists. Idle. B. T. Cannon, 505 Templeton Building, Salt Lake City, Utah, owner.

Satisfaction Mine (quartz). It is 1 mile northwest of San Andreas, joins the Gottschalk mine on the north. Martin Donallan, Frank Solinsky, of San Andreas, owners.

Scorpion Mine (quartz). It is 1 mile south of West Point, on ridge southeast of Soap Root Gulch. North shaft 275 feet deep. South shaft 65 feet deep. Idle. M. Denison, M. Postner, of West Point, owners.

Shaw Mine (quartz). It is 3 miles north of Murphy, on ridge between San Domingo Creek and Sullivan Gulch. Vein 2 feet wide, has a footwall of serpentine and hanging-wall of slate. Shaft 145 feet deep and crosscut tunnel 245 feet long connecting with tunnel. Idle. A. S. Shaw & Bros., of Murphy, owner.

Sheep Ranch Mine (quartz). (See Reports VIII, p. 131, and XI, p. 175. M. and S. P., July 1, 1905.) Elevation 2250 feet. At Sheep Ranch, on ridge between San Antonio and O'Neils creeks. Controls the following claims: Ferguson, Wallace, McNair, Aspinwall, North Star, Peoche, Salamanda, Admiral Dewey, Roscoe, Alabama, Franklin, Lodi, Eureka, Elk, Hurricane, Toom. Total area, 200 acres. The strike of vein is N. 56° W., dip 75° NE. Vein has a width of 1 to 2 feet, with a hanging-wall of gray slate and footwall of black siliceous slate. Ore occurs in shoots with a trend of 45° E. The quartz is free milling, most of the value occurring in free gold, the sulphurets being too low grade to ship, only running about $16 per ton. This property has been noted in the past for the high-grade specimen rock produced. There are three incline shafts on property. Sheep Ranch or Main shaft has a depth of 1350 feet. Chavanne shaft 600 feet southeast of main shaft is 600 feet deep, caved. Lodi shaft is 125 feet deep and sunk on a parallel vein. There are 8500 feet of drifts below 900-foot level, above this level the ore has been stoped out to surface and filled; 520 feet of crosscuts, 700 feet of winzes. Winze sunk back of shaft from 1300-foot level to depth of 200 feet; 1400-foot level drifted 900 feet to east from winze. On 1500-foot level drifted 150 feet east and 160 feet west. Only small amount of stoping has been done below 1300-foot level.

Equipment: Two 80 h.p. boilers, one 70 h.p. boiler, 200 h.p. engine, 16″ x 24″ double-drum steam hoist, 1 Burley upright compressor, driven by 100 h.p. motor (1200 cubic feet of air), 1 Burley upright compressor driven by 50 h.p. motor, 8-inch Cornish pump driven by 50 h.p. Westinghouse motor. This pump was capable of handling 150,000 gallons per twenty-four hours, raising water to 300-foot level to a drain tunnel 2400 feet long.

Mill: Twenty stamps, weighing 900 pounds each, 14″x26″ Blake crusher. Driven by 50 h.p. motor. Straight amalgamation was done in mill and no attempt at concentration was made, the tailings going to storage dam for treatment by cyanide plant. After mine was shut down a 50-ton cyanide plant installed to treat the stored tailings. Percolation method of treatment used. The cost of handling and treatment was 58 cents per ton. Some of the costs made when mine was in operation during 1907 are as follows:

Costs (not including administration charges):

Sinking main shaft	$48 25 per foot
Drifting	4 50 per foot
Sinking winzes	20 00 per foot
Mining, milling and development	7 50 per ton

During last operation 43,150 tons were milled from 1300 and 1400-foot levels, which had an average value of $10.65 per ton, on which an extraction of 80.3% was made in straight amalgamation.

This mine has record of treating 400,000 tons, and bullion receipts of $4,000,000. Idle since 1907. C. L. Feusier, of Sheep Ranch, owner, 1027 Green street, San Francisco.

Shenandoah Mine (quartz). (See Reports XI, p. 176; XII, p. 96.) Situated on Jesus Maria Creek, 5 miles northwest of El Dorado. The altitude of lower tunnel on creek is 1600 feet. Company owns three claims: Way, Hoosier, Mary Lory; also Way Mill site and Hoosier Mill site. Total of 63 acres. The country rock is a hydro-mica schist, and quartzite, east of which is an area of amphibolite schist and diorite; these rocks strike northwest. The system of fissures on lower workings N. 20° E., dip 60° W. Vein is white quartz with a width of 2 to 5 feet. The central portion of the vein, which extends over two spurs of main ridge, has, by weight of the mountain, been bent over to the east giving the vein a dip of 75° E., with a strike of N. 7° E. The torsion of the rocks has resulted in the faulting of the vein 40 feet to northwest. The mine is being operated from lower tunnel or No. 1, 1630 feet long, which gives 900 feet of backs on vein. Five other tunnels have been driven on vein, No. 2 tunnel at an elevation of 1770 feet is 800 feet long, No. 3 at an elevation of 2000 feet is 755 feet long, No. 4 at an elevation of 2043 feet has a length of 270 feet, Nos. 5 and 6 are short tunnels on vein, altitude of the latter is 2217 feet. The elevation of outcrop on top of ridge is 2500 feet.

Shenandoah Mill: One 8″x12″ Dodge crusher, 2 Challenge ore feeders, 10 stamps, 1000 pounds per stamp, dropping 6 inches, 100 drops per minute, crushing 3 tons per stamp through 30-mesh wire screen, two 6-foot Frue vanners. Mill run by 50 h.p. gasoline engine during dry season, and by water power taken from company ditch on Jesus Maria Creek. The power wheel is 3-foot Knight, running under a 90-foot head. Tailings from mill are being stored, as a cyanide plant is being installed for their treatment. Twenty-two men are employed. Shenandoah Mines Company, Clunie Building, 519 California street, San Francisco, owners. A. Tischer, manager.

Shotgun Mine (quartz). Situated 8 miles south of San Andreas on Cherokee Creek, near Demarest mine. The vein is a mass of quartz stringers cutting the gray slates, in a diabase formation. Shaft 70 feet deep on vein. Two men employed sinking shaft. J. J. Loyd, of San Andreas, owner.

The Smith & Crooks Mine (quartz). It is 2½ miles south of Angels. To the north of the Hardy mine. Ore has been developed by a tunnel 100 feet long and a shaft 33 feet deep. Width of vein is 20 to 50 feet. Two men employed driving tunnel. Norman Smith, of Angels, owner.

Smythe Mine (quartz). Report XIII, page 120. It is ¼ of a mile west of Vallecito, on Red Hill. Shaft 60 feet deep, and tunnel 300 feet in length. Idle. Chas. Smythe Estate, of Angels, owners.

Smythe Mine (quartz). (See Report XIII, p. 98.) It is ¾ mile northwest of Angels. Worked through a vertical shaft 200 feet deep, and opened up for 500 feet on 100 and 200-foot levels. Mine equipment consists of single-drum hoist driven by 25 h.p. motor; 2-drill Fairbanks-Morse compressor driven by 30 h.p. motor.

Mill: 9″ x 16″ Blake crusher, 10 stamps, 750 pounds per stamp, four 4-foot Frue vanners. Smythe Mining Company, of Angels; Chas. D. Smythe, general manager; L. Siegler, superintendent.

Soap Root Mine (quartz). It is 1 mile south of West Point. Shaft 185 feet deep. Idle. Martin Bergum, of West Point, owner.

Sonoma Mine (quartz). It is 4 miles north of Murphy, on Indian Creek. Two shafts, 125 and 110 feet deep. Idle. W. S. Sellsby, of Los Gatos, Cal., W. H., Whitney Estate, of San Franicsco, owners.

South African Mine (quartz). Located 4 miles south of Mokelumne Hill, on Old Woman's Gulch. Prospect. Idle. Geo. Edwards, of Mokelumne Hill, owner.

South Bank Mine (quartz). It is 4 miles north of Murphy, on Murphy to Sheep Ranch road. Shaft 300 feet deep, caved. Vein 12 inches wide in country rock of mica schist.

Mill: 9″ x 16″ Blake crusher, 20 stamps, 1000 pounds per stamp, four 6-foot Frue vanners. Idle. Clary Gold Mining Company, San Joaquin Valley Bank Building, Stockton, Cal., owners.

The South Carolina Mine (quartz). (See Report XIII, p. 120). This mine is situated 1 mile southeast of the town of Carson Hill, on the east slope of Carson Hill, at an elevation of 1700 feet. Consists of one claim 1500 feet by 600 feet. This property was reopened in 1903 and has been in steady operation since that date. General strike of vein is northwest and southeast, with a dip of 70° NE. The mine has been developed by a series of tunnels; the lower tunnel, 800 feet below the outcrop of vein on ridge, has a length of 1000 feet. Middle tunnel, 500 feet below apex of hill, is in a distance of 400 feet. Upper tunnel, 300 feet below apex of hill, has been driven on vein a distance of 300 feet. The work is carried on through this upper tunnel, the ore being mined by means of an open cut above tunnel level. The ore is free milling, carrying from 1 to 3% sulphurets.

Mill: 9″ x 15″ Blake crusher, driven by 20 h.p. motor. Twenty stamps weighing 1000 pounds to the stamp, dropping 6 inches at 100 drops per minute, crushing 5 tons per stamp through 20-mesh wire screen. Inside and outside amalgamation used. From the sluices the battery pulp passes over four Union concentrators. A 50 h.p. motor drives stamps and concentrators. Electric power is supplied to plant by Union Water and Power Company at a cost of $5 per horsepower.

Ore being milled averages from $2.50 to $5 per ton, and an extraction of 75% is made, tailings running as high as $1.25 per ton due to tellurides in ore. Mining and milling costs are $1.75 per ton. Property is being operated under bond by South Carolina Mining Company, of Angels; T. A. Perano, manager.

Spring Day Mine (quartz). At Glencoe. In slates of Calaveras formation. South shaft 180 feet deep. North shaft 92 feet deep. Width of vein 2 feet, strike N. 10° W., dip 65° E. Equipment 5 h.p. gasoline hoist, 30 h.p. boiler, 10 h.p. single-drum steam hoist. Two men employed sinking north shaft. W. H. Pile, of Glencoe, owner.

Spring Gulch Mine (quartz). Prospect 2½ miles northwest of West Point, on ridge south of Skull Flat Gulch. Three men employed sinking shaft. H. J. Mason of Lodi, owner.

Starlight Mine (quartz). Three miles southwest of El Dorado. Shaft 145 feet deep. Idle. C. M. Ross and J. Johnson of Stockton, owners.

Star of the West Mine (quartz). Located 3 miles northeast of West Point, on ridge north of Skull Flat. Shaft 275 feet deep. On 100-foot level drift 80 feet north and 50 feet south. Average width of vein 18 inches, strike N. 15° W., dip 80° W. Granodiorite on footwall and hanging-wall. Equipment: 60 h.p. boiler, 25 h.p. single-drum steam hoist. Eight men employed. Chas. Harker and Mrs. M. B. Werle, care Western Gas and Acid Works, Emeryville, Cal., owners; J. J. Yeckel, manager.

Standard and Early Bird Mines (quartz). They are 3 miles southeast of West Point, on the Licking Fork of the Mokelumne River. In slates of Calaveras formation. Property being operated through two tunnels. Lower tunnel 85 feet long, upper 60 feet in length. Three men employed. J. L. Haley, of West Point, owner.

Steger Mine (quartz). It is 3 miles west of West Point, adjoining the Buena Vista mine. Steger tunnel 450 feet in length. Incline shaft 130 feet in depth. Adelaine shaft 150 feet deep. Average width of vein 18 inches, strike N. 12° W., dip 65° W. Formation is granodiorite Four men employed driving Steger tunnel. Three-stamp mill on property. Fernando Stewart, of Butte City, Cal., owner. Under bond to Edward Peabody, of West Point.

Stonewall Mine (quartz). (See Report XIII, page 120.) Three miles south of Murphy. Shaft 85 feet deep. Tunnel 620 feet long. Idle. George Taylor, of Murphy, owner.

Stonewall Jackson Mine (quartz). Three miles south of Glencoe, on ridge north of the North Fork of Calaveras River. Tunnel 300 feet on vein. Shaft 50 feet deep. Idle. J. C. Woodcock, T. C. Woodcock, of Glencoe, Cal., owners.

Sultana Mine (quartz). (M. and S. P., Nov. 26, 1904.) Situated to north of Angels Mine. Vertical shaft 700 feet deep sunk on vein. Two veins have been opened up on this property, on the 100, 300 and 700-foot levels. West vein has a hard diorite footwall and a heavy talcose slate hanging-wall, with a dip of 65° E. East vein hard diorite hanging-wall with heavy schists footwall, vein has a dip of 80° E. These veins are parallel, with a strike of northwest and southeast.

Equipment: Two horizontal boilers, 80 h.p. Rix double-drum hoist, 8-drill Rand compressor, 4-drill compressor made by Angels Iron Works, run by 40 h.p. motor. One 9″ x 16″ Blake crusher, run by 25 h.p. motor.

Mill: 20 stamps, 850 pounds each, 12 4-foot Frue vanners. Idle. Shaft caved. Property has not been in operation since 1905. Sultana Mining Company, of New York; Charles Jacobson, agent.

Summit Mine (quartz). Three and one-half miles south of Railroad Flat, on Esperanza Creek. Vein 2 feet wide with footwall of porphyry and hanging-wall of mica schist. Tunnel 288 feet long driven on vein. Idle. W. B. Swank, of Mountain Ranch, owner.

Sunrise Mine (quartz). Near Esmeralda, on ridge between San Antonio and Indian creeks. Prospect. Idle. F. Martin, Lawrence Bones, of Angels, owners.

Sunrise Mine (quartz). It is located ½ mile southwest of Vallecito on the east slope of Red Hill. Course of vein is northeast and southwest, having an average width of 3 feet, with a slate footwall and granite hanging-wall. Two tunnels on the vein, upper 110 feet long, lower 250 feet long. Two men employed driving lower tunnel. Sun Rise Mining Co., 545 Sixteenth street, Oakland, Cal., owners. William Harfst, manager.

Swiss Mine (quartz). It is 4 miles east of Railroad Flat, on ridge southwest of South Fork of the Mokelumne River. Shaft 204 feet deep. Tunnel 1200 feet in length. Course of vein is north and south, dip 75° W., averages 5 feet in width. Ten-stamp mill on property. Idle. T. W. Taylor, Judge Hancock et al., of Railroad Flat, owners.

Tanner Mine (quartz). It is 1½ miles northeast of Murphy, on southwest slope of Chaparral Hill, controls 41 acres. Vein has an average width of 8 inches, with a strike of N. 30° E., dip 70° E. Both walls are of Calaveras slate. Work is carried on through a tunnel 700 feet in length, which gives 280 feet of backs. Ore high grade, averaging from \$20 to \$80 per ton. Equipment consists of 10″ x 10″ Nagle Corliss compressor driven by 30 h.p. motor.

Mill: 8″ x 12″ Dodge crusher, 7 stamps, 1000 pounds per stamp, 2 Challenge ore feeders, 1 Standard concentrator, 1 Gates vanner. Mill run by 50 h.p. motor. Ore crushed through 40-mesh wire screen. An extraction of 80% is made. Loss in tailings amounts to \$1.14 per ton. Concentrates have a value of \$15 per ton. Electric power from Union Water Company at \$5 per h.p. Twelve men are employed. East Belt Development Company, 341 Thirteenth street, Oakland, Cal., owners. J. A. Campbell, manager.

Thorp Mine (quartz). It is 6 miles south of San Andreas, near Fourth Crossing. An incline shaft has been sunk 700 feet on 55° angle, on vein that consists of series of quartz veins and parallel stringers in a zone of schists 20 feet in width. On 300-foot level vein has been drifted on 200 feet to south; on 400-foot level, 150 feet to south; on 500-foot level 100 feet south; on 600-foot level 250 feet south. Mine equipment consists of one 60 h.p. horizontal boiler, one Babcox & Wilcox boiler, forty 4-inch tubes 14 feet long, 160 pounds pressure, double-drum hoist; 50 h.p. Atlas steam engine drove Cornish pump.

Mill: 10″ x 20″ rock crusher driven by 25 h.p. motor, 6 Challenge feeders, 30 stamps 1000 pounds each, twelve 6-foot Union concentrators. Mill driven by Westinghouse, Type C, 2-phase, 400-volt, 690 r. p. m. motor. Idle. A. F. Frey, Louis Allgewahr et al., of San Francisco, owners.

The "400" Mine (quartz). It is ¼ mile north of Mountain Ranch, on ridge west of El Dorado Creek. Shaft 200 feet deep sunk on vein 2 feet wide. Crosscut tunnel intersects shaft at 65-foot level. El Dorado Creek Mining Company, 1109 Eighth street, Oakland, Cal., owners. Chas. Tepper, of Mountain Ranch, agent.

Tom Smith Mine (quartz). It is 1 mile northwest of Sheep Ranch, on ridge between San Antonio and O'Neils creeks. Vein 18 inches wide, strike N. 56° W, dip 45° NE. There are two tunnels on vein, upper 400 feet long, lower 800 feet in length. E. C. Dixon, Caldwell Bros. et al., of Stockton, Cal., owners. Under option to Jobe Evans and Harry Bates, of San Francisco. Twelve men employed. Harry Bates, manager.

Tryon Mine (quartz). It is ¼ mile south of Angels. There is a shaft 320 feet deep sunk on the vein. Idle. Charles Tryon, of Angels, owner.

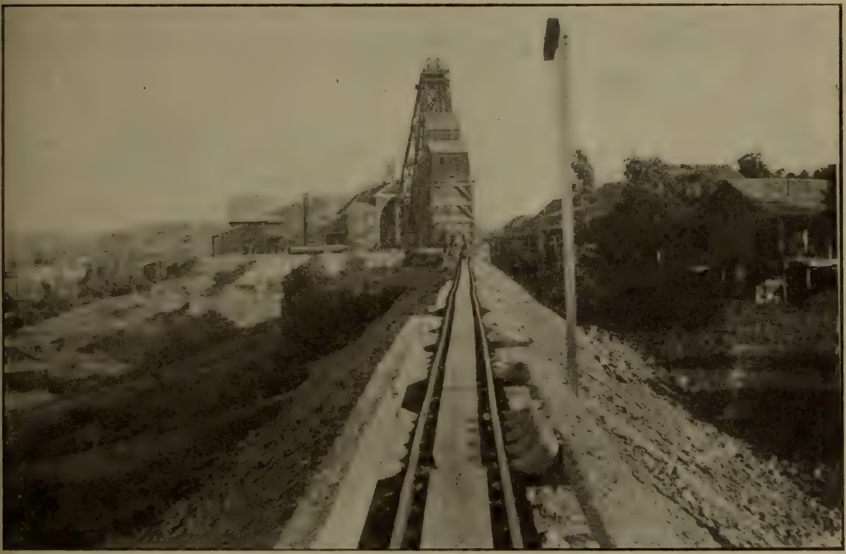
Tullock Mine (quartz). (See Report XIII, p. 98.) This mine is situated 2½ miles south of Angels on Albany Flat, at an elevation of 1400 feet. Vein has a strike of N. 50° W., and dipping 45° NE.; both the foot and hanging-walls are slate. The vein is an easterly split-off from the main Mother Lode. Ore shows quite an amount of galena and silver. An incline shaft 200 feet deep is sunk on the vein. A 16 h.p. gasoline single-drum hoist on property.

Mill: 9″ x 15″ Blake crusher, 10 stamps, 1000 pounds each; two 4-foot Tullock concentrators, 80 h.p. boiler, 50 h.p. steam engine furnishes the power to drive mill. Idle. L. R. Tullock, Mrs. D. Bisbee et al., of Angels, owners.

Union and Burgess Group of Mines (quartz). See our Reports VIII, p. 147; X, p. 63. They are located 3 miles southeast of San Andreas, on ridge east of South Fork of Calaveras River. Control the following claims: Ambrosia, Burgess, Pedro, and Union, consisting of 99 acres. Property was mined through a shaft 455 feet deep on Union claim, and vein developed on 120-foot level, 335 feet N., 150 feet S. On 160-foot level, 60 feet N.; 220-foot level 50 feet S. On 290-foot level 240 feet N.; 350-foot level 330 feet N. On Burgess claim by two shafts, No. 1 shaft 140 feet in depth, No. 2 shaft 220 feet in depth. Strike of vein is N. 47° W., with a dip of 70° NE. Shafts on Union and Burgess caved. Idle. Albert Guttinger, of San Andreas, owner.

Utica Mine (quartz). (See Reports VI, Part II, p. 28; VIII, pp. 122–124; X, p. 150; XII, p. 98, M. and S. P., November 26, 1904.) This property is located at Angels at an elevation of 1450 feet. Includes nine claims as follows: Utica, Stickles, Raspberry, Brown, Washington, Dead Horse, Jackson, Confidence and Little Nugget. The mine is located on what is called the Dead Horse lead, which has a strike of northwest and southeast, dipping 70° NE. The vein shows an average width of 60 feet of ore with an average value of $3.60 per ton. Work has been opened up through two vertical shafts, main working shaft being the Cross shaft with a depth of 1470 feet; 1100 feet north of Cross shaft on 1400-foot level winze 700 feet deep to 2100-foot level;

1600-foot crosscut from 1500-foot level connects Utica workings with Gold Cliff workings on 2400-foot level. The Stickles shaft, which has a depth of 1000 feet, is used only for lowering timbers; also as an emergency pumping shaft. The water is handled from this shaft by a 6-inch 6-stage centrifugal pump, driven by 200 h.p. motor. There are over 100 miles of underground workings on this property. The ore is hoisted through Cross shaft (3-compartment, 7′ x 16′ in the clear) in 4-ton skips by a 600 h.p. double conical drum hoist run by water power, and dumped at the head of shaft over a grizzly of 3″ round iron bars. 10′ long, placed 1¾″ apart and set at an inclination of 40°. At lower end of grizzly the rock passes to 10″ x 26″ Sturtevant crusher. The crusher and grizzly are set over a 50-ton bin from which the ore is conveyed to mill by electric tram to 200-ton capacity bins. Mining and development are carried on with air drills, air supplied by three compressors, one run by water power, and two by electric power, including a new Laidlaw-Dunn-Gordon (size 22″ x 24″, 14″ x 24″) 2-stage compressor. Water is hoisted out of this shaft by water skip of 1500 gallons capacity.



Headframe at Cross shaft, Utica Mining Company, Angels Camp, Calaveras County, California. Photo by W. W. Bradley.

Utica Mill: 60 stamps, weighing 1000 pounds per stamp, dropping 7 inches at 104 drops per minute and crushing 5 tons per stamp through No. 1 punched screen. Pulp concentrated on thirty-six 4-foot Frue vanners. Mill is driven by 150 h.p. motor. Power furnished by Union Water Company, which is controlled by Utica Mining Company, at a cost of $2 per h.p. An extraction of 85% is made in amalgamation and concentration with a loss in tailings of 25 cents per ton. The method of mining is by square set and fill on upper levels, but the management proposes to use the open stope and pillar system on lower levels. Total operating costs are $2.15 per ton. Timbers cost $2.30 per stick and lumber $18 per thousand. One hundred and fifty-five men are employed. Utica Gold Mining Company, Hayward; Hobart and Lane Estates, Merchants' Exchange Building, San Francisco, Cal., owners. F. J. Martin, general manager.

Voinich Mine (quartz). It is located 6 miles south of Angels and controls the following claims: Delmascia, Dubovanic, and Fields homestead, a total of 90 acres. Vein lies in black slate, and strikes north and south, with a dip of 60° E. Three-compartment incline shaft sunk on vein. Equipment consists of a double-drum steam hoist, 12 drill Rand compressor, two 80 h.p. horizontal boilers. Property idle. Voinich Gold Mining Company, of Stockton, owners.

Washington Mine (quartz). It is 4 miles north of Murphy, on ridge between Indian and San Antonio creeks. Strike of vein is N. 35° E., dip 85° S., 12 inches wide. Crosscut tunnel 1200 feet long. Character of ore is base, containing galena, zinc blende and pyrite. Walter Oslin, of Sheep Ranch, owner.

Water Lily Mine (quartz). (See our Reports VIII, p. 141; XII, p. 90.) Located 1½ miles east of West Point, on south slope of Valentine Hill. Two parallel veins on property in granite formation. Two shafts sunk on veins, depths 230 feet and 125 feet, caved at collar. Idle. W. T. Sessnon, B. F. Porter, of San Francisco, owners.

The Waterman Mine (quartz). It is 1 mile west of Angels. Controls one claim called Waterman (600 feet by 1500 feet). The vein on this property strikes northwest and southeast, and dips 50° NE. This vein has been prospected by a series of diamond drill holes to the depth of 1000 feet. A concrete foundation around collar of shaft has been laid and it is planned to install a steel gallows frame. Company planning to sink a shaft to depth of 1000 feet. Waterman Mining Company, owners. T. A. Coons, of Lordsburg, president; H. A. Coons, superintendent.

Wheelock Mine (quartz). It is 2 miles southwest of Sheep Ranch, on ridge between San Antonio and Indian creeks. Vein 4 feet wide, strike northwest and southeast, dip 80° NE. Vein highly impregnated with iron pyrites and containing free gold. There are three tunnels on the vein, upper, middle and lower, lengths being 100, 180, 300 feet. The lower tunnel gives 600 feet of backs. Edward Latora, Chas. Latora, of Sheep Ranch, owners.

Whittel Mine (quartz). Located 4 miles south of Angels, near Carson Creek; shaft caved and machinery removed. Frank Solinsky, John Reddick, of San Francisco, owners.

Wide Awake Mine (quartz). It is 5 miles southwest of Railroad Flat, on ridge south of Esperanza Creek, on east and west vein, dip 85° N. Wide Awake shaft 100 feet deep. Shady Side shaft 100 feet in depth. Five-stamp mill on property. Idle. Geo. I. Wright, of Railroad Flat, owner.

Wilbur Womble Mine (quartz). Situated near the town of Hodson, on ridge northwest of Little John Creek. The vein on this property is in the form of a stringer ore deposit, consisting of a mass of quartz stringers cutting the schists, accompanied by a massive outcropping of quartz, which is more or less barren, the values being in the quartz stringers cutting the schists. The ore zone is from 50 to 100 feet in width, strike of vein being N. 40° W., with a dip of 35° NE. The footwall of vein is a black slate and the hanging-wall a hard diabase. There is a soft black slate gouge on footwall. Developments consist of an incline shaft 185 feet in depth. On 160-foot level there is a drift 200 feet north and 250 feet south. Pay shoot developed has a length of 450 feet with a width of 50 feet. Ore averages $3 per ton in free gold with 2% pyrite. Sulphurets assay $30 per ton.

Hoist and mill of Wilbur Womble Mine, Hodson, Calaveras County, California.

Mine equipment: 25 h.p. single-drum hoist, 12″ x 9″ x 12″ Laidlaw-Dunn-Gordon compressor driven by 75 h.p. motor.

Mill: No. 2 Gates gyratory crusher; 15-stamp Merrill mill, stamps weigh 1000 pounds, 5 Standard concentrators, 3 Gates vanners. Mill driven by 40 h.p. motor. Eight men employed. Property being reopened by present company. Hodson Mining Company, Frank Brown, president, W. R. Womble, secretary, Milton, owners.

Wolverine Mine (quartz). It is 4 miles northwest of Railroad Flat. Shaft 400 feet deep, caved. Idle. Edwin Taylor Estate, of Railroad Flat, owners.

Woodhouse Mine (quartz). Situated 4 miles southwest of West Point, on ridge between the Middle and South forks of the Mokelumne River. Shaft 175 feet deep. Tunnel 150 feet in length. Idle. Walter P. Hill, of San Francisco, owner.

GOLD MINES—PLACER. (Drift and Hydraulic.)

The ancient channel system of Calaveras has been extensively discussed in our Report XII, pp. 482–492, also in Professional Paper No. 73, published by the U. S. Geological Survey, "The Tertiary Gravels of the Sierra Nevada of California." On the Mokelumne Hill system of channels on Stockton ridge near Mokolumne Hill, active operations are being carried on in opening up old and new properties, and the prospects look bright for a heavy production of gold from this famous old camp. In the neighborhood of Railroad Flat there are several properties operating on the Fort Mountain channel.

Hydraulic operations have been resumed by the Moosehead Water Power and Mining Company at Calaveritas and Cave City. In the San Andreas district a number of drift mines are being reopened and the results obtained have been very encouraging.

The prospects look very bright for an increased activity in gravel mining in this county, owing to the increase in the water supply due to the abundant rains during the past year.

Avalanche Placer Mine (hydraulic). It is 2 miles east of Vallecito, on Table Mountain channel. Idle. Thos. Cox Estate, of Stockton, owner. Thomas Cox, of Stockton, agent.

Big Bend Placer (*Banner Blue Gravel*) *Mine* (drift). Five miles northeast of Mountain Ranch, on Jesus Maria Creek. On Fort Mountain channel. Two tunnels on channel, one 360 feet, the other 380 feet in length. Two shafts to bedrock 62′ and 68′, depths. Two men employed. W. B. Swank, E. R. Trammal, of Oakland, owners. W. B. Swank, of Mountain Ranch, agent.

Boire Placer Mine (drift). Located ½ mile north of Railroad Flat, on Fort Mountain channel. Course of channel north and south, width of pay gravel 40 to 60 feet, with an average depth of 5 feet. Channel developed by two bedrock tunnels, 400 feet and 600 feet in length, an extensive area has been breasted. Bedrock is a soft mica schist. The gravel is slightly cemented. The gravel is disintegrated in a Cox pan and washed in sluice boxes. Amount of gravel handled, 120 tons per twenty-four hours. Property worked only when water is plentiful. Four men are employed. F. W. Boire and C. A. Boire, of Railroad Flat, owners.

Boyd Placer Mine (drift). It is 1½ miles east of Vallecito, on Murphy Gulch channel. Idle. James Clark, Thomas Kennedy, of Stockton, owners.

Buffalo Mine (drift). It is 2 miles south of Mokelumne Hill, on Chili Gulch. Deep Blue Lead channel. Controls the following claims: Buffalo Placer Mine, Hughes & Sons Deeper Gravel, Seigel, Reed, Bornhart, total of 160 acres. Course of channel is north and south. Shaft 250 feet deep to slate bedrock. Channel capped by basalt 100 feet thick. Idle. D. M. Riordan, of New York City, owner.

Calaveritas Placer Mine (hydraulic). It is located ¼ of a mile southeast of Calaveritas on Calaveritas Hill, between San Antonio and Calaveritas creeks. Water supply from Table Mountain Hydraulic Mine, also 18 miles of 1000-inch ditch from McKinneys and O'Neils creeks; 3 miles 18-inch and 22-inch pipe line with a head of 200 feet. Bank of gravel 1500 feet long, 135 feet high, reported to average 20 cents per cubic yard. Equipment, besides hydraulic pipe and giants, are: 10-stamp mill and Price rotary mill. Twenty men employed. A. Baldwin and L. Baldwin, 21 Pine street, New York City, owners. E. C. Rigney, manager.

Carpenter Mine (drift). It is located 2 miles southwest of Mokelumne Hill, on Chili Gulch Deep Blue Lead channel. Work being carried on through shaft 150 feet deep. Gravel hoisted with 15 h.p. single-drum electric hoist, crushed in an 8-stamp mill, weighing 850 pounds per stamp. Eleven men employed. W. H. Brewster, of Mokelumne Hill, owner.

Cataract and Wide Awake Gravel Mine (hydraulic). Five miles southeast of Murphy, on Central Hill channel. Course north and south. H. W. B. Lake, of Oakland, owner.

Central Hill Hydraulic Mine (hydraulic and drift). (See Report XII, pages 91 and 482.) At Douglas Flat, on Central Hill channel. A drain tunnel 2400 feet long was driven into the Central Hill mine through 900 feet of lava cap and 1500 feet of slate bedrock. Width of pay gravel was 30 to 100 feet, with a depth of 5 feet. This mine was formerly worked by hydraulic method. Idle. William H. Thomas, of Douglas Flat, owner.

Chapman Gravel Mine (drift). One mile south of San Andreas, on the central Hill channel. Controls 163 acres. The channel has been developed by four shafts sunk to bedrock: Boman shaft 165 feet, Chapman 185 feet, Marshall No. 1 shaft 200 feet, Marshall No. 2 shaft 100 feet, all sunk along the course of the channel. These shafts showed that the gravel was capped by a breccia of basaltic and andesitic pebbles 30 feet in thickness.

Equipment consists at Chapman shaft of a 15 h.p. electric hoist 10″ x 10″ Ingersoll-Rand compressor, 6-inch Neilson double action geared pump driven by 15 h.p. motor. G. D. Clark, 116 Natoma street, San Francisco, I. N. Chapman, Alameda, owners.

Chispa Gravel Mine (drift). Two miles north of Murphy, on ridge between San Domingo and Indian creeks. Controls 357 acres. Shaft to bedrock 52 feet deep. Two tunnels on rim of channel, one 50 feet long, other 100 feet in length. Seven mile ditch conveys water to property from San Domingo Creek. Property idle on account of shortage of water. F. A. Mitchler, of Murphy, O. D. Harrington, of Sonora, Tuolumne County, owners.

Clover Leaf Placer Mine (drift). It is 1 mile south of Mokelumne Hill, on west slope of Stockton Ridge. The work is carried on through a tunnel 1800 feet in length at an elevation of 1350 feet. The channel on property is called the Stockton Ridge channel, which was reported very rich. Four men are employed driving tunnel for channel. The holdings consist of 83 acres. Chas. H. Wilson, owner, 513 Bartlett street, San Francisco. L. M. Ludovici, superintendent.

Coffee Mill Mine (drift). It is 4 miles south of Mokelumne Hill, on the east slope of Golden Gate Mountain, and is on Kraemer channel. Tunnel 900 feet in length, being retimbered. Five men employed. Edward Stocker, of Fosteria, owner.

Corral Flat Mine (drift). It is 1 mile southwest of Mokelumne Hill, on northwest slope of Stockton Ridge, located on Corral Flat channel. The holdings amount to 40 acres. At an elevation of 1260 feet the channel is developed by a tunnel 1800 feet in length driven in rhyolite capping. Course of this channel is northeast and southwest. The channel has been prospected by numerous winzes sunk from tunnel level to bedrock, as the tunnel is in lava about 60 feet above the bedrock. Four men are employed retimbering and cleaning out old workings. Corral Flat Mining Company, Rialto Building, San Francisco, owner. Edward Johnson, superintendent.

Cultus Placer Mine (drift). It is 1 mile northeast of Railroad Flat, on Fort Mountain channel. Two bedrock tunnels, 225 feet and 285 feet in length. Idle. J. T. Jones, of Railroad Flat, owner.

Duck Bar Placer Mine (river bar). It is 6 miles northeast of Vallecito, on the North Fork of Stanislaus River, consists of three claims on the river, named, Duck Bar, Wild Goose, and Enterprise, controlling 80 acres. Working the bar of the river by turning the course of the stream, operations being carried on during the summer months only. Ten men are employed. Duck Bar Placer Mining Company, Stockton, owner. E. Madison, superintendent.

Duryea Placer Mine (drift). It is 2 miles south of Mokelumne Hill, on Duryea channel. Controls 130 acres. Channel developed by two tunnels, Duryea tunnel 2000 feet long and Safe Deposit tunnel 700 feet in length. Course of channel northeast and southwest, thickness of basalt capping being 100 feet. Width of channel is from 80 to 100 feet, depth of gravel being 50 to 100 feet. Extensively hydraulicked in past years. Idle. T. C. McSorley, of Mokelumne Hill, owner.

Eastland-Gray Development Company (drift and hydraulic). It is located 3 miles north of San Andreas, on the North Fork of the Calaveras River. Previous method of working gravel was in sluicing off the overburden and handling the gravel in limestone crevices by means of a Brown bucket hoist. The gravel occurs in crevices on contact between schists and limestone, the strike of the schists and limestone being N. 40° W. A parallel series of porphyry dikes cuts diagonally across schists and limestone. The boulders are in the form of rhyolite, andesite and quartzite, with a small amount of quartz boulders. Some are rounded, others subangular.

Equipment consists of 3 miles of ditch, 2000 feet of 10-inch and 16-inch pipe line under 250-foot head. Treatment consists in elevating material by Brown hoist of 1½ cubic yards capacity per bucket to Gates revolving screen, which will treat 1000 cubic yards of gravel per twenty-four hours. This property has been under operation from 1905 to 1912, during which time $80,000 has been extracted. Two men employed in prospecting crevices. Eastland-Gray Development Company, owner, 501 Grant Building, San Francisco.

Eclipse Placer (*Infernal*) *Mine* (drift). (See Report XIII, page 109.) It is 3½ miles southeast of Mokelumne Hill, on Tunnel Ridge channel. Elevation 1210 feet. Course of channel is north and south. Work carried on through a tunnel 225 feet in length, width of channel is 100 feet, depth of gravel 4 to 6 feet. Channel capped with basalt flow. Four men employed. Roger Johnson, owner, 645 Mills Building, San Francisco.

Emery Group of Mines (hydraulic). One mile south of El Dorado. Controls the following claims: Humboldt, Rose Hill, Perano, Valley Land, Bradford, Pasche & Bush placer mines; total of 510 acres on El Dorado channel. Controls water rights on Jesus Maria and Little Mokelumne creeks. Twenty miles of ditch from Jesus Maria Creek, 16,000 feet of 16-inch to 30-inch pipe line. Idle. Emery Gold Mining Company, Bradford, McKean County, Pa., owners. Louis Emery, president.

Eureka Placer Mine (drift). Located ½ mile north of Railroad Flat. West tunnel 800 feet, east tunnel 300 feet. Two men employed. J. L. Miller, of Railroad Flat, owner.

Fairview Placer Mine (drift). It is 2 miles east of Vallecito, on Cataract channel. Tunnel 300 feet long and shaft 100 feet deep. Idle. Luke Sanguinetti, Albert Sletten et al., of Vallecito, owners.

Fine Gold Placer Mine (drift). It is 2 miles southeast of Vallecito, on the Cataract channel. Tunnel 300 feet long. Four men are employed. Alvin Lundberg, of Stockton, owner. Luke Sanguinetti, superintendent.

Forty-nine Placer Mine (drift). At Douglas Flat on Coyote Creek, located on Central Hill channel. The work was carried on through shaft 185 feet deep, sunk to bedrock. From this shaft 2000 feet of drifting along channel to north and south has been done. Equipment consists of two 80 h.p. boilers, double-drum hoist driven by water power; 4500 feet of 4-inch pipe. Idle. Forty-nine Gold Placer Mining Company, owners. J. M. Evans, of Douglas Flat, agent.

Gaston Hill Placer Mine (hydraulic). Two miles south of Mountain Ranch, on Gaston Hill, on El Dorado channel. Bartola Solara and Guiseppe Cuneo, of El Dorado, owners.

Green Mountain (McSorley) Mine (drift and hydraulic). It is 1¾ miles southeast of Mokelumne Hill, on Tunnel Ridge channel. Controls the following claims: Green Mountain, Green Mountain Extension, Green Mountain East Extension, Chili Gulch, Boucher & Bracket (all patented); total holdings of 220 acres. Course of channel northeast and southwest. Width of channel 100 to 200 feet. Depth of gravel 6 to 12 feet. Main tunnel 1800 feet in length, series of tunnels of different lengths on channel and also some large hydraulic pits on property. This mine also noted for large quartz crystals found, and sold for gem purposes. Idle. J. S. Bogle, 518 California Building, Tacoma, Wash., owner.

Hartman Mine (drift). It is 3 miles southeast of Mokelumne Hill, on Old Woman's Gulch channel, course of channel northeast and southwest, width of channel 50 feet, with a depth of gravel of 4 to 6 feet. Gravel was worked through two shafts 50 feet in depth to slate bedrock. Idle. Owner, Mrs. John Myers, 613 Sutter street, Stockton, Cal.

Hedrick Placer Mine (drift and hydraulic). It is 2 miles south of San Andreas, on Central Hill channel. Developed by bedrock tunnel 400 feet long and shaft 118 feet deep. There are five shafts sunk on the property along the course of the channel, depths of 50 to 120 feet. Three tunnels 400 feet long, 150 feet in slate bedrock and 250 feet in cemented gravel. The gravel is 60 feet deep, capped with a breccia of andesitic and rhyolitic pebbles. Two men employed. George Hedrick, of San Andreas, owner.

Hexter Placer Mine (drift). It is 1½ miles southwest of Mokelumne Hill, on northwest slope of Stockton Ridge, and consists of 338 acres.

At an elevation of 1225 feet, a tunnel 2000 feet in length has been driven in the diorite bedrock underneath the rhyolitic and andesitic capping that forms the crest of Stockton Ridge. The channel developed is called the Duryea channel, which has been drifted on 500 feet north and 500 feet south. The gravel developed shows a width of 150 feet and 7 feet in depth of pay gravel. It is only slightly cemented and is easily treated in a Price rotary mill which will handle 250 tons in twenty-four hours. The gold is amalgamated in 70 feet of sluice boxes containing Hungarian riffles. The black sands are concentrated on a No. 4 Deister table. Six to thirty men are employed. Owners, Stockton Ridge Consolidated Mining Company, Hearst Building, San Francisco, Cal. S. Hughes, manager.

I X L Placer Mine (drift). Five miles northeast of El Dorado, on Fort Mountain channel. Sinking incline shaft on rim of channel. Four men employed. J. J. McIntire, Miles Standish, 255 California street, San Francisco, Cal., owners.

Johnny Jumper Placer Mine (drift). It is ½ mile north of Railroad Flat, on ridge southeast of Spruce Gulch, on Fort Mountain channel. Bedrock tunnel 600 feet in length, shaft 100 feet in depth. Idle. J. Lester, P. Lester, of Railroad Flat, owners.

Lloyd Gravel Mine. It is located 5 miles northwest of San Andreas, on Deep Blue Lead channel. Controls 110 acres. The channel was developed by three vertical shafts, 90 feet, 117 feet and 210 feet deep, all sunk to bedrock; also an incline shaft 300 feet deep sunk on the rim. Idle. Heath & Co., Boston, Mass., owners.

Manitou Placer Mine (drift). It is 1 mile northwest of Vallecito, on Central Hill channel. Idle. T. M. Edwards, of Vallecito, owner.

McCann Placer Mine (drift). It is 3 miles south of Mokelumne Hill, on Tunnel Ridge channel. Tunnel 1200 feet in length. Idle. Frank Peek, of Mokelumne Hill, owner.

Mead Mine (drift). Located 3 miles southeast of Mokelumne Hill, on Old Woman's Gulch channel. Shaft 50 feet deep, 8-stamp mill, 850-pound stamps. Idle. W. C. Mead, 730 Jefferson street, Stockton, Cal., owner.

Missouri and Dolly Varden Mine (drift). Located at Douglas Flat, on Coyote Creek, on Central Hill channel. Shaft sunk on channel 92 feet to bedrock. The gravel was treated in a revolving screen, size ¼-inch, oversize going to sluice boxes, the fines going to 4 Hancock jigs where black sands and fine gold were saved. Idle. California Extraction Company, 748-750 Mills Building, San Francisco, Cal., owners.

Mutt Placer Mine (creek bar). One mile west of Sheep Ranch, on O'Neils Creek. Idle. Fred Willie, of Sheep Ranch, owner.

Noce Placer Mine (hydraulic and drift). It is 5 miles east of Mokelumne Hill, on Whiskey Slide Hill. Worked only during rainy season. John Noce, of Whiskey Slide, owner.

North Hill, South Hill, Whiskey Hill, Bunker Hill, Sand Hill, Placer Mines (hydraulic). Located 3 miles east of Jenny Lind. Have been extensively hydraulicked. Idle. California Company, 115 Broadway, New York City, owners.

North Star Placer Mine (drift). It is 2½ miles south of Mokelumne Hill, on Old Woman's Gulch channel. Controls the following claims: Empire, McDonough, New Combination, Three Ball, Empire No. 2, Shuman, McGuire and Bondie, with a total of 600 acres. On Old Woman's Gulch channel. General course of channel is north and south, with width of channel developed 80 to 200 feet, and a depth of gravel of 6 to 10 feet. Channel capped by basalt. Work was carried on through 2800-foot bedrock tunnel and there is over one mile of workings on the channel. Bedrock is a decomposed granodiorite and slate. Idle. North Star Mining and Development Company (Gustave Bowman, president; Thomas Applegarth, secretary), Holland House, New York City; L. Everett, of Mokelumne Hill, agent.

North Star Placer Mine (drift). It is ¾ mile east of Altaville, on Central Hill channel. The channel has been developed by a tunnel 800 feet in length. Property idle 1914 on account of shortage of water. Norman Smith, James Bennett et al., of Angels, owners.

O'Connell Blue Gravel Mine (drift). Two miles southeast of San Andreas, on Central Hill channel. Shaft 56 feet deep. O'Connell Bros., of San Andreas, owners.

Paragon Placer Mine (drift). It is 2½ miles east of Angels, on Central Hill channel. Controls 140 acres. Work was carried on by tunnel 1490 feet in length, driven 600 feet in slate bedrock, remaining distance in loose gravel. Width of pay gravel developed 200 feet, with a depth of 3 feet. Property closed down on account of litigation over ownership. Hutchinson & Co., of Angels, owners.

Ranier Mine (drift). Located 1 mile north of Angels, on Central Hill channel. Controls four placer claims: Hecla, Aetna, Vesuvius and Alta, containing a total of 400 acres. Property has been developed by shaft 325 feet deep, from which shaft 1000 feet of drifting was done along the channel. Channel is lava capped by rhyolite tuff, 60 to 240 feet in thickness. Character of gravel loose and cemented. Equipment on property consists of a new 60-foot head frame, electric double drum hoist, driven by 160 h.p. motor; 15-drill compressor, driven by 50 h.p. motor. Mine shut-down on account of heavy flow of water struck in lower levels. J. A. Perano et al., of Angels, owners.

Reed Gravel Mine (drift). It is located 5 miles northwest of San Andreas, on Latimer Gulch, on the Deep Blue Lead channel. Controls 157 acres. Course of channel is north and south. The channel is developed by incline shaft sunk on the rim of bedrock at angle of 20° to a depth of 616 feet. A drain tunnel 2000 feet in length taps the incline shaft, draining workings. Channel drifted on 500 feet to north and 450 feet to the south. Reported $80,000 taken out of this mine. Equipment consists of 20 h.p. boiler, 4-stamp mill, weight of stamps being 750 pounds. Workings caved. Idle. J. J. Hicky and Chas. Lamb, of Lodi, Cal., owners.

Rising Star (Casinelli) Placer Mine. It is 5 miles northwest of San Andreas, on Deep Blue Lead channel. Controls 58 acres. Course of channel is north and south. Channel developed by tunnel 1800 feet in length, connected with a shaft 150 feet below surface, 900 feet from tunnel entrance. Channel is capped by a breccia of andesitic and rhyolitic pebbles, from 20 to 150 feet in thickness. The width of pay gravel is 100 feet, with an average depth of 4 feet. Method of treatment is as follows: The gravel is first allowed to slack, then run through concrete mixer with grizzly bars set $\frac{1}{8}$-inch apart, driven by 6 h.p. gasoline engine, capacity of mill 400 tons per twenty-four hours. The gravel washed in sluice boxes containing Hungarian riffles. Gravel from workings is hauled to bin in six 1600-pound capacity cars by 20 h.p. 4-cylinder gasoline engine. Two men employed in straightening out main tunnel, with the idea of resuming operations when the water supply is increased by the rains. Ancient River Corporation, 60 State street, Boston, Mass., owners. J. O. Whitney, manager.

Rooney Gravel Mine (drift). Located 3 miles south of Mokelumne Hill, on Chili Gulch, Deep Blue Lead channel. Course of channel northeast and southwest, width 80 to 100 feet, depth of gravel 4 to 6 feet. Vertical shaft 150 feet deep. Single-drum hoist. Five-stamp mill on property. Idle. T. H. Rooney Estate, of San Francisco, Cal., owners.

Roosevelt Placer Mine (drift). It is $2\frac{1}{2}$ miles east of Angels, on Central Hill channel. Developed by shaft 60 feet deep to bedrock, and channel being drifted on. Six men employed. Morris Val, of Angels, owner.

Rough Diamond Placer Mine (drift). It is 3 miles south of Mokelumne Hill, on Tunnel Ridge channel. Tunnel 700 feet in length. Justinian Caire Company, 573 Market street, San Francisco, Cal., owners.

Rough Diamond Placer Mine (drift). It is situated $4\frac{1}{2}$ miles east of Angels, on the Central Hill channel. Controls 40 acres. Three men employed. L. J. Hutchinson, David Oard, of Angels, owners.

Square Head Placer Mine (drift). It is 2 miles south of San Andreas, on the Central Hill channel. The channel is capped with a breccia of basaltic and andesitic pebbles, which on this property is 20 feet thick. Tunnel driven in bedrock of slate for 450 feet and 100 feet in blue cemented gravel; width of pay gravel mined was 150 feet wide, with a depth of 7 feet. Shaft 93 feet deep connects with tunnel. Width of channel on this property from rim to rim is 280 feet, depth of gravel being 63 feet. Idle. M. J. Hertzig, of San Andreas, owner.

Stockton Hill Mine (drift). It is in the townsite of Mokelumne Hill, on the northeast slope of Stockton Ridge. Work being carried on through a shaft 160 feet deep. Mrs. A. C. Nuner and G. W. Pfortner, Mokelumne Hill, owners.

Table Mountain Placer Mine (hydraulic). It is 2 miles west of Sheep Ranch, on ridges between San Antonio, O'Neils and McKinley creeks. Controls 2500 acres. On Fort Mountain and El Dorado channels. Water supply from O'Neils and San Antonio creeks. There are 58 miles of 1100-inch ditch and two miles of 10-inch pipe line, which supply water to giants under a head of 210 feet.

Width of pay gravel 1000 feet with a depth of 20 feet. Gravel will average about 25 cents per cubic yard. Tailings are stored by series of brush dams, also by a cement dam 22 feet high and 460 feet long. Eight men are employed. Moose Head Water Power and Mining Company, A. Baldwin, L. Baldwin, of New York City, owners; E. C. Rigney, manager, 21 Pine street, New York City.

Table Mountain Placer Mine (drift). It is 4 miles south of Vallecito, on Table Mountain, located on Cataract channel. Course of channel north and south. Incline shaft 130 feet deep, and 110 feet of drift from incline in hard granodiorite bedrock. Four men are employed drifting in bedrock to get below channel. Table Mountain Consolidated Mining Company, Merchants' National Bank Building, San Francisco, Cal., owners. C. E. Montgomery, superintendent.

Table Rock Gravel Mine (drift). It is 3 miles northeast of Sheep Ranch, on west slope of Table Rock Mountain. Tunnel 2200 feet long under lava cap. Workings caved. Idle. J. J. Fischer, W. C. Armstrong et al., of Sheep Ranch, owners.

Texas Placer Mine (drift). At Douglas Flat, adjoins the Forty-Nine Placer Mine. Shaft 90 feet deep. Manuel Estate Company, of Murphy, Cal., owners. Mathew Manuel, of Murphy, agent.

Union Shaft Mine (drift). It is 4 miles northwest of San Andreas, on Central Hill and Deep Blue Lead channels. Two shafts 100 and 150 feet in depth are sunk on channel. The course of channel is north and south. Workings caved. Judge T. H. Reed, of San Andreas, owner.

Vallecito Gold Mining Company (drift). (See our XII Report, pages 99, 482.) Located in the townsite of Vallecito, on Central Hill channel. Controls four claims: Bonney, Bowling Green, Dashaway, Ruby. Two shafts on property, 110 and 50 feet deep. Thomas Bishop Estate, of San Francisco, Cal., owners.

Viola Placer Mine (hydraulic and drift). It is $\frac{1}{4}$ of a mile northwest of Douglas Flat, on Central Hill channel. Tunnel 700 feet in length, 400 feet in slate bedrock, the remaining distance in gravel. F. Orth, Edward Prathero et al., of Douglas Flat, owner.

West Lake Mine (drift). It is 3 miles southwest of Mokelumne Hill, on Chili Gulch Deep Blue Lead. Course of channel north and south. Shaft 150 feet deep. J. A. Porter, of Los Angeles, owner.

Wet Gulch Placer Mine (hydraulic and drift). It is 7 miles east of Mokelumne Hill, on Wet Gulch. Two men employed. F. C. Gnecco, L. Gnecco, of Wet Gulch, owners.

What Cheer Mine (drift). It is 3 miles southwest of Mokelumne Hill, on Chili Gulch Deep Blue Lead channel. Controls 140 acres. Incline shaft 900 feet deep. Vertical shaft 250 feet deep. Width of channel 80 to 150 feet, depth of gravel developed 6 to 8 feet. Channel capped with basalt 100 feet in thickness. Course of channel northeast and southwest. Idle. John A. Landers, Russ Building, San Francisco, Cal., owner.

Calaveras Dredge No. 1, Calaveras Gold Dredging Company, Jenny Lind District, Calaveras County, California. Five cubic-foot close-connected type of dredge.

GOLD DREDGING.

Gold dredging operations have been carried on steadily in Calaveras County since 1903, in two localities. Near Jenny Lind on the Calaveras River, there are three dredges being worked by the following companies: The Calaveras Gold Dredging Company, Butte Dredging Company and Isabel Gold Dredging Company. The Oro Light and Power

Company is operating a dredge near Camanche on the Mokelumne River. The high cost of operations in these districts is due to the heavy bank of clay and cement gravel encountered.

Calaveras Gold Dredging Company. The Calaveras Gold Dredging Company began operations in 1903. The holdings of this company comprise an area of 250 acres located in T. 3 N., R. 10 E., along the Calaveras River near Jenny Lind. The average depth of ground is 20 feet, the gravel being coarse and overlain by hydraulic tailings, also an overburden of clay and loam. In places cemented gravel has been encountered, but as a rule the gravel is loose and free, lying on a bedrock of soft clay. The dredge was constructed by the Western Engineering and Construction Company, and is equipped with Bucyrus machinery. The hull is 96 feet long and 40 feet wide, draft 4 feet 6 inches. The dredging ladder is of plate girder construction carrying seventy-eight 5-cubic foot buckets (weight 1250 pounds). The tailings stacker is a Robins belt conveyer 96 feet long carrying a 30-inch belt. The electric motor equipment installed on the dredge has a rated capacity of 234 h.p., distributed as follows:

Calaveras Dredge No. 1. Calaveras Gold Dredging Company, Jenny Lind District, Calaveras County, California. Showing bow gantry and bucket-line in operation.

Main drive motor	100 h.p.
Winch motor	20 h.p.
Stacker motor	15 h.p.
Shaker motor	15 h.p.
Main pump (one 10-inch centrifugal)	50 h.p.
Hopper pump (one 3-inch centrifugal)	10 h.p.
Clean up	3 h.p.

Two 8-inch submerged horizontal pumps in hull of boat are used as emergency pumps, driven by 20 h.p. motor. All motors are Westinghouse type, 3-phase, 60-cycle, 400 volts. A single bank of gold tables with Hungarian type of riffles is used, area of sluices being 2,000 square feet. The dredging time daily is 18 hours 12 minutes. The dredging cost amounts to 6 cents per cubic yard. Twelve men are employed. Calaveras Gold Dredging Company, 807 Alaska Commercial Building, San Francisco, Cal., owner. President, S. A. Moss; secretary, A. Boynton; G. H. Shearer, superintendent.

Butte Dredging Company. The Butte Dredging Company began operations in 1910. The holdings of this company comprise 200 acres, on the south side of Calaveras River, near the town of Jenny Lind. The average depth of ground is about 20 feet. The dredge is a Bucyrus type. The hull is 90 feet long and 36 feet wide, draft 4 feet 6 inches. The digging ladder carries seventy-two 4-cubic foot close connected buckets. The tailings stacker is a Robins belt conveyer 90 feet long carrying a 30-inch belt 188 feet long. The electric motor equipment as installed on the dredge has a rated capacity of 175 h.p. distributed as follows:

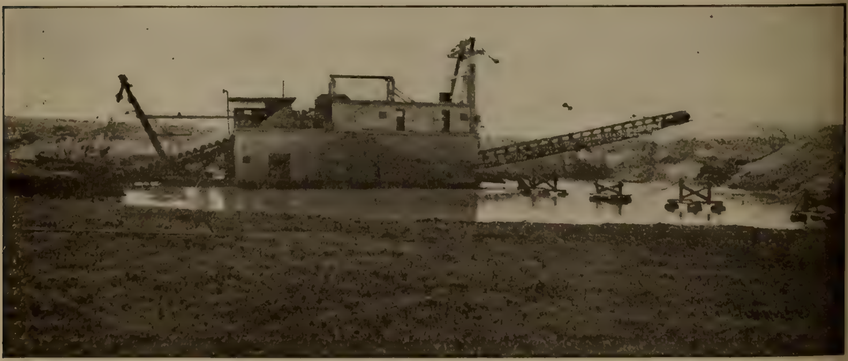
Calaveras Dredge No. 1, Calaveras Gold Dredging Company, Jenny Lind District, Calaveras County, California. Showing bucket-line, upper tumbler and tailings stacker.

Main drive motor	50 h.p
Stacker and screen motor	30 h.p.
Main pump (8-inch centrifugal)	50 h.p.
Winch motor	20 h.p.
Pump and shop motor (2-inch centrifugal)	25 h.p.

A revolving type of screen is used, size 54″ x 30′. A single bank of gold tables with Hungarian type riffles are in use, which have a grade of 1⅛-inch to the foot. The area of sluices is about 1500 square feet. The total amount of cubic yards excavated in past twelve months was 406,513, at a cost of $.0857 per cubic yard. The high cost is due to high bedrock and heavy clay encountered. The average depth of gravel dredged was 18 feet. Ten men are employed. Butte Dredging Company, Mills Building, San Francisco, Cal. W. S. Noyes, president; B. E. Noyes, secretary; W. A. Parks, manager.

Butte Dredge of Butte Dredging Company, Jenny Lind District, Calaveras County, California. Five-cubic foot close-connected. Showing tailings stacker of Robins belt conveyer type.

Isabel Dredging Company. The Isabel Dredging Company commenced operations in 1908. The holdings of the company comprise 211 acres, on the south side of the Calaveras River, near the town of Jenny Lind. The average depth of ground is about 30 feet. The character of the gravel is coarse and overlain by clay and loam, with a bedrock of soft clay. A Bucyrus type, 5-cubic foot, close connected elevator dredge carrying 78 buckets (1250 pounds). The hull of the dredge is 100 feet



Isabel Dredge of Isabel Dredging Company, Jenny Lind District, Calaveras County, California, showing bucket-line, stacker and outside sluices.

ong by 40 feet wide and draws 5 feet. The tailings stacker is a Robins elt conveyer 96 feet long carrying a 30-inch belt 202 feet in length. he electric equipment has a rated capacity of 250 h.p.

Bucket drive motor	100 h.p.
Winch motor	20 h.p.
Stacker motor	20 h.p.
Screen motor	20 h.p.
Main pump (10-inch centrifugal)	50 h.p.
Pressure pump (5-inch centrifugal)	30 h.p.
Priming pump (3-inch centrifugal)	10 h.p.

sabel Dredge of Isabel Dredging Company, Jenny Lind District, Calaveras County, California, showing bow gantry.

Two shaker type of screens with $\frac{3}{8}$-inch apertures and a single bank of old tables having a slope of $1\frac{1}{4}$-inch to the foot are in use on this boat. here are eight sets of sluices arranged longitudinally with the boat, 40 eet long by 3 feet wide, with one set of outside sluices on each side of ie boat. Hungarian type riffles are used, the area of sluices being bout 2000 square feet. The average cubic yards excavated in the last velve months was 603,679. Water is pumped from the river to float redge. The cost of dredging per cubic yard averages about 7 cents. welve men are employed. Isabel Dredging Company, 417 Montgomery reet, San Francisco, Cal. I. L. Borden, president; John Williams, ecretary; Fredric Estep, superintendent.

The Oro Water, Light and Power Company. This company began perations in 1904. The holdings of the company comprise an area of bout 250 acres of dredging land located along the Mokelumne River Calaveras, San Joaquin, and Amador counties, at the junction of iese three counties, about three miles from the town of Wallace. The oat at present operating is a 9-cubic foot, close connected elevator redge, the digging buckets being of the integral bottom and lip design, weighing 1600 pounds each, running 21 buckets per minute. The digging capacity of the dredge is 40 feet below water. The hull is 11 feet long and 45 feet wide and draws 9 feet. The digging ladder is 8 feet in length, having a maximum depth of 8 feet. The revolvin type of screen is used, diameter 6½ feet with a length of 33 fee The gold saving tables have a total area of 2000 square feet o a single deck and are equipped with steel lined Hungarian riffles. Th table area is supplied by two 10-inch Yuba Construction Compan pumps, having a capacity of 2800 gallons per minute. The transformers on dredge reduce the electric current from 4400 to 440 volt The electric equipment has a rated capacity of 465 h.p. The mai digging motor is a 200 h.p. General Electric motor. The average dept of gravel is 25 feet. The monthly capacity of dredge is 225,000 cubi yards, the average running time being 20.5 hours per day, the gol recovery being about 10 cents per cubic yard. Oro Water, Light an Power Company. J. W. Goodwin, president; W. G. Jack, secretary C. G. Leeson, manager. Offices, 411 Sharon Building, San Francisc Cal.

IRON.

There is a deposit of limonite 1½ miles northeast of Murphy, whic has been developed to a small extent, and another deposit of the sam character 7 miles southeast of Mokelumne Hill on the Bonanza Min group of claims.

LIMESTONE.

At the Genelli Ranch, 1 mile north of Vallecito, limestone has bee burned in a crude kiln for local use.

Mercer's Cave. Situated 1¼ miles northwest of Murphy, and was discovered in 1885. It occurs in the limestone belt that passes throug Murphy, and consists of several large chambers which are connecte by stairways and lighted by electricity. The entire cave is 362 fee long and about 150 feet wide. W. J. Mercer, of Murphy, owner.

LeClercq Limestone Quarry. Situated 7 miles northeast of Valle Springs, on ridge south of the Mokelumne River. Idle. Adolp LeClercq, of Fosteria, owner.

Markwood Limestone Quarry. It is 5 miles northeast of Valle Springs. Idle. George Markwood, of Fosteria, owner.

McNamara Limestone Quarry. It is 5 miles northeast of Valle Springs, on the McNamara Ranch. Charles McNamara, of Fosteri owner.

Young Limestone Quarry. Situated 4 miles northeast of Valle Springs, on Young Ranch. There is an extensive deposit of limeston having a course of N. 30° W. Formerly the owners burned the lim for local use, but of late years the quarry has been idle, except when rock was sold to the smelter at Campo Seco as a flux. Idle. Andrew G. Young, of Fosteria, owner.

Plaza Limestone Quarry. Situated 5 miles northeast of Valley Springs, on the Valley Springs and Mokelumne Hill road. The entire output is used for flux at the smelter of Penn Mining Company. Idle. Penn Mining Company, 1713 Harris Trust Building, Chicago, Ill., owner.

MARBLE.

The Columbia area of limestone which is exposed in the neighborhood of Vallecito, Douglas Flat, and Murphy, is extremely irregular, having a general strike of northwest and southeast. Most of the limestone, although retaining a distinct bedded and schistose structure, has become a granular crystalline rock to which the name marble is applicable. When polished it is generally nearly white, marked by faint gray veinings and is rather fine grained. A small amount of development has been done on these deposits, but the quarries are idle due to their distance from railroad transportation.

In the neighborhood of Murphy, east of Mokelumne Hill, and near San Andreas, there are extensive marble deposits which are undeveloped on account of the lack of transportation facilities.

Angels Marble Quarry. Situated 3 miles southeast of the Stanislaus River. The character of the marble developed in the quarry is white, gray, fine grained and marked with faint gray veinings. Two shipments were made from this quarry, but operations were suspended on account of the high cost of transportation.

Equipment: 14″ x 9″ x 10″ Sullivan compressor, 2 marble gangsaws, 2 derrick hoists, and 1 derrick, all of which were driven by electric power. California-American Marble Company, 25 Columbia Square, San Francisco, owner. A. F. Edwards, manager.

Bishop Marble Properties. Situated 2 miles northeast of Melones, on the North Fork of the Stanislaus River. Controls 120 acres. Property undeveloped. Thomas B. Bishop Estate, 166 Geary street, San Francisco, Cal., owner.

Eagle Marble Quarry. Located 1 mile east of Vallecito, controls 160 acres. A small amount of marble has been shipped from this quarry. There is the following equipment on the property: 4-drill Ingersoll-Rand compressor, 12 h.p. derrick hoist, 2 derricks and 2000 feet of 10-inch pipe line. The character of the marble is fine grained, marked with faint gray linings. Idle. Eagle Marble Company, Stockton, Cal., owner. A. R. Kirkland, president.

MINERAL SPRINGS.

Valley Springs Mineral Water Company. Located near the town of Valley Springs, the terminus of the Southern Pacific Railroad. The water flows from a well 150 feet deep. The water is alkalo-sulphurous and rich in chlorides and carbonates. Water is bottled, charged lightly, for sale. Valley Springs Mineral Water Company, Valley Springs, Cal., owners. David Costa, manager.

Mok-Hill Natural Mineral Water. Situated at Mokelumne Hill, 16 miles northeast of Valley Springs, the terminus of the Southern Pacific Railroad.

Mok-Hill Spring was discovered in 1850, during the time of the gold rush and used by the early miners for drinking, in panning gravel, and the overflow from spring was used in ground sluicing in the gulch below the spring. Reopened and the water placed on the market by Herman Maasberg & Bros., on April 15, 1910. The water is bottled and carbonated lightly, the production yearly being about 10,000 gallons. The analysis of water in thousands is as follows:

Calcium bicarbonate	197
Magnesium sulphate	156
Sodium chloride	98
Magnesium chloride	285
Calcium sulphate	109
Calcium carbite	88
Bone ashes	67

The water is very clear, as samples have been allowed to stand four years and show no murkiness. Herman Maasberg, of Mokelumne Hill, owner.

OCHRE.

At Campo Seco, on the Holmes Ranch, there is a body of decomposed slate heavily stained with iron oxide, which forms a durable paint. There are also other deposits of the same character in the neighborhood of Valley Springs. The ocher varies in color from a light yellow to a dark reddish hue.

SANDSTONE.

Late Sandstone Quarry. Situated 1 mile south of Valley Springs. A small quarry was opened up on a bold outcrop. The stone is medium grained white sandstone. Idle. Mrs. E. E. Late, of Valley Springs, owner.

Wildermuth Quarry. Situated 3 miles northeast of Valley Springs. The stone is soft, gray sandstone and is not very compact. Idle. Isaac Wildermuth, of Valley Springs, owner.

SLATE.

Running through Calaveras County there is a great belt of black slate, having a northwesterly and southeasterly course, and which has been exploited to some extent near Tower's Ranch, 2 miles west of Copperopolis, on the Copperopolis and Oakdale road.

SOAPSTONE AND TALC.

Two and one half miles west of Murphy, on the French Gulch road, some talc has been taken out for local use. One mile southwest of Vallecito there is a 50-foot cropping of drab colored talc. It has been quarried for local use for firebacks and boiler linings.

Laidet Ranch. Situated 6 miles east of Mokelumne Hill, on the Calaveras River, in Sec. 3, T. 5 N., R. 12 E. There is a deposit of good grade talc, 3 feet in width, also a reef of soapstone 50 feet wide, and can be traced for 1000 feet on the property. Idle. Aime Laidet, of Mokelumne Hill, owner.

TUOLUMNE COUNTY.

Field work in April, 1914.

INTRODUCTION.

Description.

This county is bounded on the northwest by Calaveras County, on the northeast by Alpine and Mono, on the south by Mariposa, and on the southwest by Stanislaus.

Like most of the counties lying along the main gold belt, Tuolumne covers a portion of the foothills and the westerly slope of the Sierra Nevada, giving the whole county a rugged surface, and to the eastern portion a considerable altitude. A remarkable feature in the topography and geology of this county is the basaltic mesa known as Table Mountain, which, running near and parallel with its northwestern boundary, extends for a distance of nearly thirty miles. This formation consists of a lava flow, which, having filled the channel of an ancient river, stands now, through the degradation of the adjacent country, an isolated mass, its top nearly level and its sides nearly perpendicular—the former more than two thousand feet above the bed of the Stanislaus River, which breaks through it. Flowing through the county in a westerly direction is the Tuolumne River, with its three forks; also three forks of the Stanislaus River—all large streams—the main Stanislaus and its north fork forming in part the boundary between Tuolumne and Calaveras counties.

The county also has scores of lakes, among them Lake Eleanor, a beautiful body of water, which, with Hetch-Hetchy Valley, is one of the scenic wonders of the State. San Francisco aims to secure its entire water supply from the Tuolumne River.

Tuolumne County is not only well supplied with water, but is also abundantly timbered; the more elevated portions being covered with fir, pine, spruce and cedar, and the lower elevations with scrub oak and pine.

While gold mining continues to be the leading industry, farming, viticulture, fruit growing, lumbering and stock raising are here important and growing pursuits. The extensive limestone and marble deposits are being developed on a large scale, and the Columbia Marble Company, owner of the famous Columbia quarry, turns out a product that in beauty, durability and susceptibility to a brilliant polish, is the equal of any other in the United States.

Power plants.

Tuolumne Water Power Company. This property consists of storage reservoirs on the South Fork of the Stanislaus River, main and distributing ditches, and small distributing reservoirs.

The generating station is operated under a static head of about 1000 feet; the four generators of 2500 horsepower capacity are driven by four direct-connected Pelton water wheels, and the power is transmitted by about 30 miles of transmission lines to the principal towns and mines operated by electrical energy. The company also maintains about 85 miles of ditches for mining and agricultural purposes.

Stanislaus Electric Power Company. This power plant on the Stanislaus River generates electric power to operate the street car system of the United Railroads in San Francisco and other cities, while at the same time furnishing lights and power to many places, including towns and mines of this county. The main reservoir, at Relief, has a storage capacity of 550,000,000 cubic feet of water. The electric plant generates 35,000 horsepower.

Railway facilities.

The county has the advantage of direct communication with Stockton by means of the Southern Pacific Railroad to Oakdale, thence over the Sierra Railroad to Jamestown, where one branch runs to Angels Camp, Calaveras County, the other to Sonora and Tuolumne City, the last named being the terminus of the road.

Wagon roads.

Considering the rough character of the country in the county, the roads from the railroad points to the different mining districts are better as a whole than those of any other territory similarly situated.

Mineral resources.

The mineral resources of Tuolumne County consist of chrome, copper, gold, lime, limestone, marble, mineral paint, platinum, soapstone, silver, stone industry, sulphur.

Mining conditions.

There is increased activity in mining operations in Tuolumne County, especially on the Mother Lode belt in the neighborhood of Jamestown, where extensive operations are being carried on at the Jumper, Dutch, and Harvard mines, and the prospects look bright for the reopening of the App and Rawhide mines, which were famous producers in the past. In the neighborhood of Jacksonville, the Eagle Shawmut mine, after a year's shut down for the installation of electric hoisting and underground tramway equipment, has resumed operations on an extensive scale, and will handle a larger tonnage than ever. On the east belt, in the granodiorite area in the Soulsbyville district, the wonderful showing of the Black Oak mine (which, through its modern cyanide plant has successfully demonstrated the treatment of the base ores of this district), has caused a renewal of interest in this belt by mine operators, as several old and new properties are being reopened.

In the neighborhood of Tuolumne there is a notable revival in mining, as the New Albany and Providence mines have resumed operations and promise to be steady producers.

Increased activity is being shown in pocket mining on Jackass Hill, near Tuttletown, and on Bald Mountain in the neighborhood of Sonora and Columbia.

Owing to the large amount of rain during the past year, a great number of gravel mines have reopened, and there should be a great increase in production from this source of mining. An extensive amount of development is under progress on the ancient river channels of Table Mountain, especially notable being the driving of a 6000-foot tunnel by the Springfield Tunnel and Development Company at Columbia, which if successful will mean a boom for this famous old camp as a gold producer.

In this county there still remains a large area of unexplored territory, on both the central and east belts, which only wants the capital to open up new producing mines.

CHROME IRON.

Deposits of chromite occur in a belt of serpentine southwest of Chinese Camp, and there are also abundant loose masses of small size in serpentine northwest of Mountain Pass.

Marianno Iron Mine is 1½ miles west of Chinese Camp, on the Marianno ranch. There are several shallow deposits of chromite, on which a small amount of development has been done, in the way of open cuts and shallow shafts. The ore developed is of very good quality, but not enough work has been done on these deposits to determine their extent. Several shipments have been made to Atkins, Kroll & Co. J. F. Marianno, of Chinese Camp, owner.

COPPER.

Copper Belt. Through the western end of the county the copper belt presents two branches. It enters the county from the north closer to the Mother Lode belt than elsewhere, being from 2 to 3 miles westward.

The two divisions of the belt diverge somewhat in crossing the county southeastwardly, and both are marked at intervals by outcrops of cupriferous veins and by old shafts of shallow depth, which indicate the many prospecting efforts of former periods. The western branch of the belt is the stronger one. From Copperopolis, in Calaveras County, it enters Tuolumne County at Byrne's Ferry and passes through the Don Pedro district to the southeast. The eastern branch enters the county just west of Tuttletown and passes out at Moccasin Creek, at the south. There are no developed properties on this belt, but the belt is clearly defined and exhibits favorable indications.

Mines.

Mackey Ranch Mine is a prospect 2½ miles south of Jamestown, on ridge west of Woods Creek. Ore occurs in lens-shaped deposit in belt of serpentine, showing oxides and sulphides of copper. Shaft 125 feet deep. Idle. Peter Mackey, of Jamestown, owner.

Mann Copper Mine is 3 miles south of Jamestown, in a belt of serpentine lying to the west of the Mother Lode. Shaft 90 feet deep. Character of ore, chalcopyrite, associated with pyrite. Idle. D. L. Mann, of Jamestown, owner.

Mitchell (or *Bonne Terre*) *Mine.* About 1 mile west of Oak Hill mine, on patented ground. Shaft 100 feet deep. Idle. Locke Robinson et al., of Sonora, owners.

Oak Hill Copper Mine (see Bull. No. 50, p. 250).

Washington Mine (see Bull. No. 50, p. 249). In Sec. 30, 31 and 32, T. 2 S., R. 15 E. W. E. Henseley et al., owners.

GOLD.

Geology.

Mother Lode Belt. Passing southward from Calaveras County into Tuolumne at Robinson's Ferry, the Mother Lode belt is found to continue in an almost unbroken line to the southern boundary of the county, and beyond into Mariposa County. There is a slight break in its continuity near Tuttletown, another break of about 1000 feet between Whiskey Hill and the Dutch mine, and still another near the foot of Priest's Hill, on Moccasin Creek. The lode is characterized by its massiveness and distinguished by the persistent occurrence of massive quartz croppings and broad zones of ankerite. Some of the most important mines on this lode are found not in the belt of ankerite and quartz, but in the hanging-wall side of the ankerite zone.

Some mines along the lode have serpentine as a footwall, as in the Jumper and Rawhide mines.

The Mother Lode system may be divided into three veins: the footwall vein, boulder vein and hanging-wall (or east) vein.

The pay ore is found in the form of a stringer lead, consisting of a mass of quartz stringers cutting the schists and clay slates, while the main boulder vein of quartz is very low grade, and as a rule does not pay to mine.

The East Belt. The mines of the East Lode, which are found from 6 to 18 miles east of the Mother Lode belt, occur in the slates of the Calaveras formation and in granodiorite. The east belt veins are gold bearing, containing auriferous pyrite and some galena. The ore bodies are formed in lens-shaped ore shoots. The character of the ores in the granodiorite is base, containing free gold associated with the heavy sulphides, pyrrhotite, marcasite, sphalerite, galena, pyrite, and some chalcopyrite.

Big Oak Flat and Groveland Districts. In the quartz-diorite area at Big Oak Flat are several large veins which dip at small angles, varying from 25° to 55°. These veins are not confined to the granite, but extend into the surrounding schists. The veins have been extensively exploited on the Mississippi, Mack, and Longfellow claims. In the hard mica schists in the neighborhood of Groveland are numerous gold quartz veins, which have been exploited in the past, but at present writing there are no mines operating in the district.

In the Big Oak Flat district the Mack and Longfellow are operating on a small scale. The ores in these districts are free milling, occurring in lenses. The values as a rule are confined to the free gold in the quartz, and the sulphurets are low grade.

GOLD MINES—QUARTZ.

Abbie L. Mine (quartz). At Big Oak Flat, on Eureka-Mississippi vein. Tunnel 200 feet long. Idle. M. W. Hilliard, of Big Oak Flat, owner.

Alabama Mine (quartz). (See our Reports X, pp. 53, 741; XI, p. 298; and XIII, p. 472.) It is 2 miles northwest of Jamestown, on the south slope of Table Mountain. Three veins on property—east, boulder and west. The boulder vein shows massive quartz croppings, with an ore zone from 20 feet to 200 feet wide, which was mined from an open cut and a shaft 300 feet deep. The veins have a course of N. 25° W., dip 65° NE. Large body of low-grade free milling ore, containing 25% pyrite. Idle. Joseph D. Redding, Crocker Building, San Francisco, owner.

Alameda Mine (quartz). (See our Reports X, p. 55, and XI, p. 508.) Situated 3 miles northwest of Jamestown, about 1 mile north of the Rawhide mine. The walls are slate, the quartz of the vein being very irregular, and the vein matter composed of talc, quartz and mariposite. Course of vein is N. 35° W., dip 65° NE. Shaft 920 feet deep was sunk on vein, and a crosscut tunnel from Greenhorn Gulch intersected the shaft at 250-foot level. Workings now caved. Idle. Chas. Fitzgerald et al., of Quartz, Tuolumne County, owners.

App Mine (quartz). (See our Reports VIII, pp. 660–661, and XII, p. 299.) Situated 2 miles south of Jamestown, on the northwest slope of Quartz Mountain. Controls the following claims: App, Heslep, App mill site, Heslep mill site, Hitchcock, total holdings being 40 acres. Vein composed of dolomite, mariposite, containing abundant stringers and lenticular bunches of quartz, talcose schist and a dike of altered diorite. The hanging-wall is a hard diorite with a Calaveras slate footwall, having a heavy black slate gouge on footwall. Course of vein is N. 30° W., dip 65° NE; width of vein, 30 feet. Two shoots of ore were mined. Work was carried on through an incline shaft 1340 feet deep. Levels were driven on the vein north and south at intervals of 100 feet.

Equipment: 250 h.p. double-drum hoist, Ingersoll-Rand compressor, electrically driven.

Mill: Two 10″ x 20″ Blake crushers, 60-stamp mill, 1000-pound stamps, 24 Frue vanners. Mill driven by electricity. Property being reopened. Estate of T. W. Patterson, Fresno, owner. Alexander Chalmers, of Angels, agent.

Arbona Mine (quartz). Situated at Tuttletown, on ridge north of Mormon Creek. The vein is 5 feet to 10 feet wide, of solid quartz, containing a small percentage of pyrite. Course of vein is N. 35° W., dip 65° NE. An incline shaft 600 feet deep has been sunk on vein. Underground workings consist of drifts on vein on 100′, 200′, 350′ and 500′ levels. Equipment: 60 h.p. boiler, 30 h.p. single-drum hoist, 5-drill, 2-stage compressor. Mill: 6″ x 8″ Dodge crusher, 10-stamp mill, 850-pound stamps. Four 4-foot Frue vanners. Idle. Calmas Mining Company, 68 Essex street, Boston, Mass., owner.

Argentine Mine (quartz). (See our Report XII, p. 299.) Situated in American Camp district, 10 miles northeast of Columbia. J. B. Pownall, of Columbia, owner.

Atlas Mine (quartz). Located on northwest slope of Jackass Hill, 1 mile north of Tuttletown. In amphibolite schist; the ore body is from 10 feet to 30 feet wide, consisting of small irregular veins cutting the schists. Ore is free milling, with 6% pyrite. Two shafts have been sunk on the vein, main working shaft being an incline 375 feet deep. Ore is being mined on 125′, 240′, and 340′ levels. West shaft 124 feet in depth.

Ore is hoisted by single-drum, direct-driven electric hoist, driven by 40 h.p. motor. A 480-cubic-foot Ingersoll-Rand compressor, driven by 75 h.p. motor, furnishes air for drills. Incline tramway from mine to mill, 600 feet long. A 5 h.p. electric hoist hauls $1\frac{1}{4}$-ton cars from mill to bins.

Mill: 9″ x 16″ Blake crusher, 10 stamps (weighing 1050 pounds per stamp), dropping 6 inches, 104 drops per minute, crushing $4\frac{1}{2}$ tons per stamp through 35-mesh screen; two Callow tanks having a capacity of 50 tons, two No. 4 Deister tables, one Gates concentrator, and two 6-foot Frue vanners. Concentrates have a value of $25 per ton. An extraction of 82% is made by amalgamation and concentration.

Twenty-five men are employed. Atlas Mines Company, Jamestown, owner. T. L. Whitney, manager.

Banner Mine (quartz). It is 2 miles southeast of Big Oak Flat, on Cobbs Creek. Tunnel 300 feet, shaft 60 feet. The course of vein is due E. and W., dip 45° N. Idle. Chas. Harper, C. E. Watson of Big Oak Flat, owners.

Bell Mine (quartz). Located 1 mile west of Tuttletown, on ridge northwest of Mormon Creek. The vein is in the form of a stringer lead, consisting of a mass of quartz stringers cutting the schists. Vein has an average width of 30 feet, with black Calaveras slate footwall and a hanging-wall of diabase. Course of vein is N. 35° W., dip 65° NE. Work was carried on through an incline shaft 600 feet deep, with drifts north and south on vein at 300′, 400′, 500′ and 600′ levels. Idle. Philip Rowe, George Rowe et al., of Tuttletown, owners.

Belmont Mine (quartz) is 1 mile north of Sonora, on ridge east of Woods Creek. Mined for rich pockets. Series of shafts and tunnels on property. Two men employed. G. E. Garrett, of Sonora, owner.

Bellevue (*Hyde, Golden Treasure*) *Mine* (quartz). (See our Reports VIII, p. 670; X, p. 755; XI, p. 501, and XII, p. 299.) It is 6 miles northeast of Sonora. Idle. Bellevue Mining Company, San Francisco, owner.

Bicknell Mine (quartz) is 1 mile east of Big Oak Flat, on an east and west vein dipping 38° N. Developments consist of three tunnels, 300 feet, 200 feet and 100 feet in length. Idle. Mrs. Raggio, of Big Oak Flat, owner.

Black Hawk Mine (quartz) is a prospect 1 mile west of Soulsbyville. The strike of vein is northeast and southwest, dip 85° SE. The formation is granodiorite. Crosscut tunnel is 125 feet long. Idle. R. A. Nichols, of Soulsbyville, owner.

Black Oak Mine (quartz). (See our Reports VIII, p. 665; X, p. 744; XI, p. 500; and XII, p. 299. Bulletin 18, p. 137, by W. H. Storms.) Situated 1 mile west of Soulsbyville, and comprising the following claims: Black Oak, Live Oak, White Oak, Carra, and Carra Fraction. It occurs in granodiorite. The vein varies from 1 foot to 25 feet in width, and has several branches coming in from the hanging-wall side. The course of the vein is N. 15° E., with a dip of 60° to 70° W. The ore forms in kidneys and lenses on the intersection of diorite dike crossings and in the neighborhood of a fault. The diorite dikes vary from 1 to 2 feet in width, with a strike of N. 55° E., having a vertical dip. On the 1300-foot level, 385 feet north of shaft, the vein was found to be faulted 110 feet to the west; course of fault is N. 60° E., with a dip of 75° N. The ores are quartz, containing iron, copper, lead and zinc sulphides, in the form of pyrrhotite, sphalerite, marcasite and galena.

Work is carried on through a shaft 1700 feet deep on 70° incline. On the 1700-foot level the shaft is 16 feet in the footwall. Levels are driven on the vein north and south, 100 feet apart. Stoping operations are being carried on in the 1000-foot, 1300-foot, 1400-foot and 1500-foot levels. Two ore shoots have been developed—one north of shaft, 500 feet long, with an average width of 4 feet; the other south of shaft, 300 feet long, with a width of 20 feet. Ore hoisted by 100 h.p. single-drum electric hoist. Air for drills, pumps and underground hoist furnished by 19″ x 16″; 11″ x 16″ Ingersoll-Rand compressor. Water handled by 10″ pump, 8″ Jack head pump, and two 6″ x 8″ horizontal duplex Dow pumps.

A view of the Black Oak Mine, Soulsbyville, Tuolumne County, California.

Mill: 10″ x 20″ Blake crusher, 20 stamps, weighing 1250 pounds each, dropping 6 inches, 100 drops per minute, crushing 3.5 tons per stamp through 10-mesh Tyler ton cap screens. Ore is crushed in 1.85% cyanide solution, or 3.7 pounds of cyanide per ton of ore. The pulp from the batteries passes to a Dorr standard duplex classifier, from which the coarse material goes direct to a 5′ x 18′ tube mill, being diluted to 39% moisture. Slime overflow passes through the treatment tanks. Discharge from tube mill is returned to classifier by bucket elevator (closed circuit used). The tube mill is driven by 75 h.p. motor, with a chain drive; mill makes 23 revolutions per minute. Pulp from classifier goes to 20′ x 10′ Dorr thickener, thickened from 6 to 1 consistency to 2 to 1 for agitation, and pulp from thickener is elevated by 2½-inch air lift. Three Pachuca type agitators 10′ x 30′ are connected for continuous agitation. A spider with six radiating jets supplements the main working air jet as a help in starting at any time. The spider and main jets are connected with both high pressure air and high pressure water. An 8″ x 10″ Ingersoll-Rand compressor furnishes air at 40 pounds pressure for the agitators, air lift and vacuum filter. Power for agitation is 3.4 h.p. per agitator. Pulp from agitators flows to another Dorr thickener (10′ x 20′), and overflow from No. 2 thickener to collecting tank, from which it is pumped to the clarification and precipitation presses. The thickened underflow passes to the filter. The filter is an Oliver, with a drum 11′ 6″ in diameter and a 12-foot face. Capacity 100 tons per day. Cake formed from one half to five eighths inch thick. Solution from filter discharges into collecting tank and is pumped to two 24-inch, 36-frame Shriver filter presses for clarification. From the gold tanks, the clarified solution is pumped to a 52-inch, 16-frame Merrill press, and zinc dust added to suction of the pump. The barren solution passes from the precipitation press to the sump, from which it is returned to the stock tanks above the mill by a triplex 5½″ x 8″ Platt pump, where it is brought back to normal strength. Lime is added to the batteries and agitators (0.15 % CaO), 24 pounds of litharge added to tube mill and agitators. Mill operated by electric power from San Francisco and Sierra Power Company, coming in at 15,000 volts and transformed to 440 volts. The mill makes an extraction of 96 per cent. The cyanide consumption averages 1.5 pounds per ton of ore, lime 3 pounds. The daily capacity of mill is 75 to 100 tons per 24 hours. Ore milled averages about $20 per ton. Costs of operation are as follows:

	Per ton
Development	$1.634
Mining	2.224
Treatment	1.588
General	0.273
Incidentals and office	0.133
Assaying	0.101
Stable	0.054
Material (mill)	0.962
Labor (mill)	0.623
Total	$7.592

Eighty-six men are employed. Black Oak Mines and Milling Company, First National Bank Building, San Francisco, owner; C. E. Knox, general manager.

Blue and White Star Mines (quartz). They are 4½ miles south of Tuolumne, on ridge south of the Tuolumne River. The vein is developed by three tunnels, 320′, 150′, and 250′ in length. The course of vein is east and west, with dip 45° N. Two men are employed driving lower tunnel. J. Hienberg, Chas. F. Stucki, of Tuolumne, owners.

Blue Lead Mine (quartz). It is 3½ miles north of Tuolumne, in granodiorite formation. Series of parallel veins with a north and south strike and dipping 75° to the west. Two shafts 200 feet and 130 feet deep. Two men employed. Under lease to A. S. Burge and F. H. Rood, of Spokane, Wash. Mrs. L. E. Fowles, of Arrastraville, owner.

Boitono Mine (quartz) is a prospect, 2 miles west of Groveland. Idle. A. Boitono, of Deer Flat, owner.

Bonanza Mine (quartz). (See Reports VIII, p. 652; IX, p. 37; X, p. 736; XI, p. 511; XII, p. 299.) This property, located in the town of Sonora, on the Bonanza lead, has been famous as having produced very rich pockets, ranging from $1000 to $300,000. The vein strikes N. 30° E., dip 23° E. Width of vein is from 18 inches to 2 feet. A diorite-porphyry dike accompanies the vein on the hanging-wall side. The footwall is limestone and the hanging-wall a mica schist. Shaft sunk to a depth of 185 feet on 70° incline, then on a 23° incline for 600 feet on vein. At this level a drift was run 100 feet west on vein, then a winze sunk on the vein 800 feet deep on 23° incline. Three men are employed unwatering property, for the purpose of resuming operations. A. R. Oliver, of Sonora, owner.

Brown Mine (quartz) is 3 miles west of Tuttletown, on ridge south of the Stanislaus River. Shaft 700 feet deep, from which a 10-foot vein was cut by several crosscuts. On the 400-foot level a crosscut was driven 128 feet beyond the vein, into the hanging-wall. Idle. Brown Mining Company, of San Francisco, owner.

Buchanan Mine (quartz). (See Reports VI, Part II, p. 60; VIII, p. 666; X, p. 752; and XI, p. 494.) It is 10 miles southeast of Tuolumne, on ridge north of the middle fork of the Tuolumne River. Course of vein is northeast and southwest, dip 60° SE. Formation is a Calaveras slate. Idle. Davis Estate, of Tuolumne, owners.

Buzzard's Roost Mine (quartz). (See Report XI, p. 506.) It is 8 miles from Sonora, on south fork of Stanislaus River. Idle. Vivian & Gerloch of Sonora, owners.

Carlin Mine (quartz). At Jamestown, on Woods Creek, on vein east of main Mother Lode vein. Course of vein N. 45° W., dip 33° N. The vein has an average width of 5 feet. Developments consist of a tunnel 550 feet long. At a point in the tunnel 500 feet from mouth, sinking a 3-compartment shaft. Six men employed. Jamestown Exploration Company, owner, 32 South California street, Stockton. J. P. Mangante, manager.

Carlotta Mine (quartz). (See our Report XI, p. 499.) It is 1 mile north of Tuolumne, on ridge west of Cherokee Creek, comprising 3 claims—Carlotta, North Carlotta, Pennsylvania. Two veins on the property in granodiorite country rock. The strike of Carlotta vein is N. 45° E., dip 80° NW.; Pennsylvania vein, N. 20° E., dip 20° E. Veins have an average width of 18 inches. On the Carlotta vein there is a shaft 246 feet in depth, while the Pennsylvania vein has a shaft 200 feet in depth. The ore occurs in lenses, and the quartz contains the sulphides, pyrrhotite, sphalerite and galena. There are compressors, hoists and 5-stamp mill on property. Idle. D. B. Neagle, E. J. Murphy et al., of San Francisco, owners.

Carrington, Chillena, Santisimo, Street Extension and *Wilson & Means Pocket Mines* (quartz). Situated 1 mile northwest of Tuttletown, on Jackass Hill. The veins are irregular quartz stringers cutting the schists. Series of shafts on properties having depths of 100 to 200 feet. General course of veins is northwest and southeast, with a dip of 60° NE. Six men employed. C. A. Gillis, W. R. Gillis and T. H. Bluett, owners.

Chaparral Mine (quartz). (See our Report XI, p. 496). It is 12 miles southeast of Sonora, near Buchanan mine. The veins are in black slate and are developed by several tunnels 100 feet to 600 feet long. Idle. Fred Wenzel, of Sonora, owner.

Clio Mine (quartz). (See our Report X, p. 47.) It is ½ mile south of Jacksonville, on ridge north of the Tuolumne River. Comprises three claims, 1500 feet each in length. The vein is on the contact between slates and serpentine, having a slate hanging-wall and a serpentine footwall. Course of vein is N. 40° W., dip 65° NE. Developments consist of a crosscut tunnel 600 feet long which cuts the vein 450 feet from the mouth of the tunnel. Drift on vein north 125 feet, where a winze was sunk on the vein to a depth of 400 feet. There is a single-drum hoist, Leyner compressor and 10-stamp mill on property. Idle. Clio Mining Company, 5660 San Julian street, Los Angeles, owner. Dr. E. F. Henderson, agent.

Columbus Mine (quartz). (See Report XII, p. 301.) Situated 2 miles north of Tuolumne, on ridge west of Cherokee Creek. On the Eureka-Dead Horse lead, shows massive outcrop of quartz with an ore zone 60 feet in width. Strike of vein N. 35° W., dip 55° NE. Formation is a mica schist, the vein being accompanied by diorite-porphyry dike on hanging-wall. The developments consist of an incline shaft 230 feet deep, sunk on the vein, with drifts north and south on 100-foot and 200-foot levels. Electric hoist, compressor and 10-stamp mill on property. Idle. J. Goldman, S. C. King et al., of San Francisco, owners. T. G. Winwood, superintendent.

Confidence Mine (quartz). (See Report XI, p. 503; Bull. 18, by W. H. Storms, p. 136). Situated 7 miles northeast of Tuolumne, at an altitude of 4000 feet, in the granite area lying east of the Calaveras formation. The course of vein is N. 14° W., dip 25° E. Incline shaft was sunk on vein to a depth of 810 feet. About 600 feet north of shaft on 810-foot level there is a winze 265 feet deep. The vein varies from 12 inches to 15 feet in width. About 1200 feet north of the main shaft there is an incline shaft 810 feet deep. All machinery has been dismantled and sold, and main shaft is caved. Idle. Confidence Gold Mining and Milling Company, 1051 Mills Building, San Francisco, owner.

Consuella Mine (quartz). (See Report XII, p. 301.) It is 1½ miles southeast of Tuolumne, and east of the north fork of the Tuolumne River. Idle. D. B. Warfield, of Oakdale, owner.

Cosmopolite Mine (quartz). (See Report XI, p. 494; XII, p. 301.) It is ¾ mile southeast of Groveland, on a stringer lead. Two veins, cutting a slate formation; one with a course N. 18° W., dip 38° NE., the other N. 65° E., dip 50° NW. Crosscut tunnel 300 feet to N. 18° W. vein, with drift 300 feet north and 150 feet south. Shaft 110 feet deep. Two men employed milling dump material. There is a 5-stamp mill on the property. M. C. Merrill, of Groveland, owner.

Crystalline Mine (quartz). Situated 1½ miles west of Jamestown, on southeast slope of Whiskey Hill. Central vein shows a massive outcrop of quartz, while east and west veins are in the form of numerous quartz stringers cutting the schist. Vein material contains free gold and pyrite in a gouge of dolomite, mariposite and talcose slates. The true footwall is serpentine, with Calaveras slate hangingwall. The course of veins is N. 35° W., dip 65° NE. Average width of veins about 5 feet.

Work was carried on through a vertical shaft 625 feet deep and an incline shaft 300 feet deep, 750 feet south of main shaft. From main working shaft on 300-foot level, a crosscut was driven to vein 450 feet east and drifted on vein 750 feet south and 400 feet north. On 600-foot level, crosscut to vein a distance of 250 feet, and a drift south 600 feet, at which point a 125-foot crosscut cut east vein, which was drifted on 100 feet south and 150 feet north. Mine equipment consists of double-drum steam hoist, and 6-drill Laidlaw, Dunn-Gordon compressor.

Mill: 9″ x 15″ Blake crusher, 10-stamp mill, 850-pound stamps, four 6-foot Frue vanners, driven by 50 h.p. motor. Idle. C. E. Shafer, of Jamestown, owner.

Darrow Mine (quartz). A prospect, 3 miles northwest of Jamestown, on ridge north of Greenhorn Gulch. Operated as a pocket mine. Worked through a series of shallow shafts and tunnels. Four men employed. J. H. Darrow, of Jamestown, owner.

Deadhorse (see *United Mines.*)

Del Monte Mine (quartz.) At Groveland, on an east and west vein, in mica schist. Shaft 200 feet deep. There is a 3-stamp Nissen mill on property. Idle. Sierra Gold Mining Company, Arlington Heights, Ill., owner.

Densmore Mine (quartz). (See Bull. 18, p. 135, by W. H. Storms.) It is 2 miles northwest of Columbia, on slope of ridge east of the Stanislaus River. The course of the vein is northwest and southeast, dip 60° NE., with an average width of 5 feet. The formation is granodiorite. It is a heavy sulphide ore, containing pyrite, marcasite, sphalerite, galena and pyrrhotite. Developments consist of a tunnel 400 feet long on the vein and a shaft 500 feet deep. There is a 10-stamp mill on the property. Idle. Thomas Symonds, Murphy, et al., of Columbia, owners.

Draper Mine (quartz). Situated 1 mile west of Soulsbyville, adjoining the Black Oak mine on the northeast. Three parallel veins cut the granodiorite formation. The east vein is 175 feet east, and west vein is 170 feet west of middle vein. The course of the veins is N. 20° E., dipping from 50° to 75° W. The average width of veins is 18 inches.

Developments consist of an incline shaft 630 feet deep and drifts north and south on 100′, 200′, 300′, 400′, 500′ and 600′ levels. The character of the ores is a heavy sulphide, containing free gold associated with pyrite, pyrrhotite, marcasite, galena and sphalerite. Mine equipment consists of 60 h.p. electric hoist, 5-drill Giant compressor, 10-inch Cornish pump, electric driven. There is a 10-stamp mill on property. Ten men employed retimbering shaft and unwatering mine to resume operation. M. McCormick Company, Stockton, owner. Con Sullivan, superintendent.

Dreisam Mine (quartz). (See Bull. No. 18, p. 139.) It is 2½ miles north of Tuolumne, on ridge east of Turn Back Creek, in granodiorite formation. There are three veins on property, with the following courses: Cutter vein, N. 40° W., dip 45° NE.; Yellow Jacket vein, N. 80° E., dip 80° E.; Ophir, N. & S., dip 75° E. Average width of veins is about 18 inches. Ore forms in lenses. The veins are cut by a series of diorite dikes from 6 inches to 2 feet in width. The Yellow Jacket vein is faulted 50 feet to west by Cutter vein on 200-foot level. Work is carried on through a shaft 500 feet deep. The character of the ore is base, with free gold, pyrrhotite, pyrite, marcasite, galena and sphalerite. Ore is hoisted by 75 h.p. single-drum electric hoist. Air furnished by 2-stage Rand compressor, driven by 75 h.p. motor.

Mill: 9″ x 15″ Blake crusher, 6-stamps (3 stamps per battery), two 4-foot Frue vanners. Mill driven by 20 h.p. motor. Seven men employed. J. E. Conde et al., of Arrastraville, owners.

Duffield Mine (quartz). It is 2½ miles northeast of Tuloumne, adjoining the Driesam mine on southeast. The vein is on a contact between granodiorite and slate, with former as a footwall and the latter for a hanging-wall. Strike of vein is north and south, dip 75° W. Work was carried on through a crosscut tunnel 130 feet to vein with a drift north on vein 325 feet. Winze sunk on vein 80 feet below tunnel level. Vein has an average width of 12 inches. A 10-stamp mill on property. Idle. Andrew Scanavino et al., of Tuolumne, owners.

Duleek Mine (quartz) is 5 miles northeast of Groveland, on an east and west vein, dip 80° S. Shaft 200 feet deep. Idle. Mrs. E. Foster, Berkeley, owner.

Dutch Mine (quartz). (See Reports X, p. 51; XI, p. 509; Bull. 18, p. 130.) Situated 2 miles south of Jamestown, at Quartz Mountain. Holdings consist of Dutch, Dutch Mill Site, Sweeney, Sweeney Mill Site, making a total of 70 acres. On the Mother Lode, which is a complex structure composed of dolomite, mariposite and quartz with lenses of amphibolite schist. Both walls are of Calaveras slates. On the Dutch claim the lode splits into two veins about 75 feet apart. East vein is very irregular, breaking up into stringers which run in all directions, while the west vein is more regular.

The general course of the veins is N. 35° W., with a dip of 65° NE. Main working shaft sunk on 65° incline to a depth of 1800 feet. North of main shaft is Sweeney shaft, 200 feet deep. Levels have been driven on the vein north and south 100 feet apart to the 1200-foot level, the remaining levels being at 150-foot intervals. Work being carried on in 1000-foot, 1650-foot and 1800-foot levels. An ore body has been developed on the 1650-foot level south, 150 feet long, with an average width of 16 feet. Water is handled from 1000-foot level by Dean triplex pump, driven by 25 h.p. motor; capacity of 60,000 gallons.

The Dutch Mine, showing mill and hoist near Jamestown, Tuolumne County, California.

Equipment: 150 h.p. double-drum electric hoist, one 450-cubic foot Leyner compressor and one 1000-cubic foot Rand Duplex compressor.

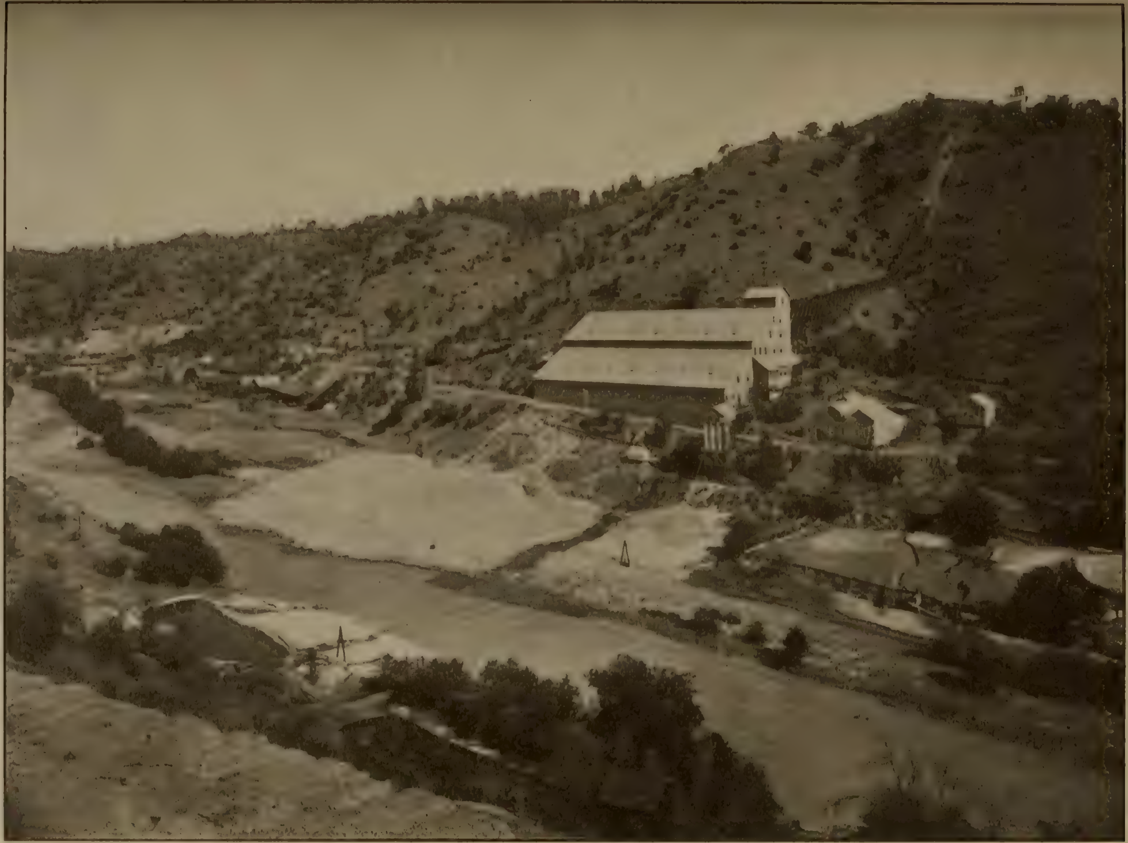
Mill: 10″ x 20″ Blake crusher, 40-stamp mill, 1050-pound stamps, dropping 6 inches, 106 drops per minute, crushing 5 tons per stamp through 20-mesh; stamps driven by two 50 h.p. motors. Pulp from batteries flows over eight 6-foot Johnson and ten 6-foot Frue vanners. Concentrators driven by 15 h.p. motor. An extraction of 86% is made by the mill. Concentrates assay $36 per ton; total operating costs are

$2.30 per ton. There are sixty-four men employed. Dutch Consolidated Gold Mining Company, Sonora, Tuolumne County, owner. C. H. Segerstrom, manager.

Eagle-Shawmut Mine (quartz). (See Report X, p. 48; Bull. 18, p. 132). Situated 2 miles northwest of Jacksonville, on Woods Creek. The vein is distinguished by massive quartz croppings along its course. The hanging-wall country is amphibolite schists; the footwall is slate. An ankerite zone contains veins or lenses of quartz carrying gold in paying quantities, besides which there is a broad zone of amphibolite schist on the hanging-wall side, in which there is a gold-bearing shoot. This rock is a heavy sulphide ore, containing about 3% auriferous sulphides. The Shawmut vein is 33 feet wide and dips 72° NE.; Eagle vein has an average width of 12 feet and dips 63° NE. Course of veins is N. 40° W. Four pay shoots have been developed on the property, from 200 feet to 400 feet long, with average width of 12 feet. Pay ore is found east and west of the main boulder vein, in the form of stringer leads, consisting of numerous stringers cutting the slates, heavily mineralized with auriferous pyrites. Ore shoots trend north. The main developments consist of a crosscut tunnel driven 1100 feet through the footwall to the vein, and a shaft sunk on the vein to depth of 1600 feet; tunnel connects with shaft on the 400-foot level; 75 feet north of main shaft a winze has been sunk on vein from 1500-foot level to a depth of 600 feet; eighteen levels 100 feet apart have been driven on the vein north and south of shaft. Ore hoisted by 200 h.p. direct-connected electric hoist, and dumped into 75-ton storage bins. Trammed from bins in two 5-ton cars, hauled by 50 h.p. electric motor, and dumped into rock breaker bins, from which it is fed by gravity to two No. 5 Gates gyratory crushers. Product from Gates crushers is conveyed by 30-inch belt conveyor, 120 feet long. Elevated by bucket elevator (buckets 12″ x 20″) to bin in center of mill above 30-inch Robins belt distributor, which distributes ore to mill bins above batteries, having a capacity of 4000 tons. A 75 h.p. General Electric motor drives crushers, conveyors and elevators.

Mill: 100 stamps, 1000 pounds each, dropping 100 drops per minute through 6 inches, and crushing 5 tons per stamp through 20-mesh screen. Pulp from battery plates flows over forty 6-foot Frue vanners, one Card table and one Deister table. Mill driven by water power.

Power plant at mine generates power for electric tram, hoists, crushing machinery and lights. Water purchased from Sierra and San Francisco Power Company, 2 miles of 10-inch pipeline from company ditch to mine, with a head of 900 feet. Concentrates from mill are treated by a 20-ton chlorination plant, operated by the company. Eagle-Shawmut Mining Company, 1024 Merchants Exchange Building, San Francisco, owner. J. Williamson, manager.



The Eagle-Shawmut Mine, showing 100-stamp mill and hoist; also the Tarantula Mine, to the north. Jacksonville, Tuolumne County, California.

Eureka and Mississippi Group of Mines (quartz). It is at the lower end of Big Oak Flat, on an east and west vein, with a dip of 30° N. The formation is quartz-diorite and mica schist. Shaft 400 feet deep and tunnel 500 feet on vein. Idle. Santa Ana Mining Company, 152 Federal street, Boston, Mass., owner.

Eureka Mine (quartz). (See Report XII, p. 302.) It is in Sonora. There are two veins about 20 feet apart, one in black slate, the other in chlorite schist. Shaft 120 feet deep. Idle. J. T. Faxon, of Sonora, owner.

Excelsior Mine (quartz). Situated 4 miles northeast of Confidence. The veins lie in a formation of granodiorite, and have a strike of north and south, with a dip of 35° E. Vertical shaft 235 feet deep; incline shaft 200 feet deep. Two men employed sinking a new shaft. Fred Sutton, of Sonora, owner.

Experimental Mine (quartz). It is 2 miles northwest of Columbia in Experimental Gulch, to the south of the north fork of the Stanislaus River. The vein is a true fissure in limestone. The course of the vein is N. 45° W., with dip 45° NE., and has an average width of 5 feet. The ore is free milling, containing coarse gold, pyrite, chalcopyrite, galena and occasionally tellurides of gold and silver.

Ore shoots are formed on intersection of cross diorite-porphyry dikes with the vein, which strike N. 60° E., dip 85° N. The mine is developed by incline shaft 300 feet deep, and a crosscut tunnel 1275 feet to vein and drift south 525 feet on vein. One 3-stamp mill at shaft, and a 2-stamp mill under operation below mouth of tunnel. Concentrates assay as high as $100 per ton. Eight men employed. Thomas Conlin, of Columbia, owner.

Florence Mine (quartz). (See Report XII, p. 302.) It it 1 mile southeast of Tuttletown. Idle. H. Orlando, of Tuttletown, owner.

Fox, Hudson, Calhoun and Ford Group of Mines (quartz). They are 1½ miles southeast of Columbia, on the north slope of Bald Mountain. The vein occurs in a mica schist and strikes N. 10° E., dip 72° E. Work is carried on through Fox tunnel, which crosscuts the vein 150 feet from the entrance, and a drift run 300 feet north and 200 feet south on the vein. A winze is sunk on vein 240 feet below tunnel level. On the Ford claim there is a crosscut tunnel 2000 feet in length to vein. Three men employed sinking winze. Thomas Conlin, of Columbia, owner.

Garfield Mine (quartz). (See Report XII, p. 302.) Situated 1 mile southeast of Tuolumne, on the north fork of the Tuolumne River. Course of vein is N. 35° W., dip 50° NE., in a mica schist. Shaft 75 feet deep. Tunnel 135 feet long. A 10-stamp mill on the property.

Idle. Garfield Consolidated Mining and Milling Company, Tuolumne, owner. F. H. Rood, superintendent.

Gem Mine (quartz) is 7 miles northeast of Confidence, on the north fork of the Tuolumne River. Comprising the following claims—Gem, Representative, Senate, Edith, Congress, Assembly, Iola, Faith placer mine, Hope placer mine, Charity placer mine, controlling an area of 320 acres.

The Gem vein strikes N. 65° E., dip 65° SE. and the Senate vein has a course of N. 15° W., dip 60° NE. The formation is granodiorite. The veins have an average width of 18 inches. The ore, occurring in the form of kidneys, is free milling, containing pyrite and galena.

Developments consist of a crosscut tunnel 380 feet in length intersecting the vein 230 feet from mouth of tunnel, with a drift 125 feet east and 75 feet west on vein, with a winze 50 feet deep on Gem vein. Above lower tunnel there is a tunnel 150 feet long on Senate vein. There is a 10-stamp mill on property, driven by water power. Ten men are employed. J. F. Wulzen, of Confidence, owner and manager.

Gladstone Mine (quartz). (See Report XI, p. 510.) It is on Kanaka Creek, 1 mile east of Jacksonville. Idle. Thomas Whitto et al., of Sonora, owners.

Golden Gate Mine (quartz). (See Reports X, p. 738; XI, p. 511; XII, p. 302.) Situated ½ mile south of Sonora, on ridge east of Woods Creek. The course of vein is N. 35° E., dip 65° E., and averaging in width about 4 feet. Both walls are slate. The mine is opened by a shaft and tunnel, the tunnel being run northeast 1100 feet on vein. The shaft is 750 feet deep, on 65° incline.

A drain tunnel 1000 feet north on vein connects with shaft on the 100-foot level. Drifts are driven on the vein north and south of shaft every 100 feet, to the 700-foot level. Winze 200 feet deep on 700-foot level north of shaft. Steam hoist and 20-stamp mill on the property. Idle. Andrew McCormick, of Stockton, owner.

Green Mine (quartz). Located 3 miles northeast of Confidence, on ridge north of the north fork of the Tuolumne River. The strike of vein is north and south, dip 30° E., in granodiorite. There is a shaft 400 feet deep on vein. Steam hoist and 10-stamp mill on property. Idle. Thos. Magee & Sons., of San Francisco, owners.

Harvard (Trio) Mine (quartz). (See Report X, p. 53; Bull. 18, p. 130.) Situated 1 mile southwest of Jamestown, on the southeast slope of Whiskey Hill. Holdings consist of the following claims: McCann, Mooney, Trio, Sobrante, and Mooney Mill Site, having a total area of 80 acres. Length along the lode of 5000 feet. Three veins called east, central (or boulder), and west, have been exploited. These veins have a course of N. 37° W., dip 60° NE. The lode—which is very

The Harvard Mine, showing hoist and mill. Jamestown, Tuolumne County, California.

prominent, forming the central portion of Whiskey Hill—on the north end of the Trio claim shows massive quartz croppings, having a width of 100 to 300 feet. Average width of veins is about 10 feet. The central vein consists partly of a body of solid quartz from 6 to 12 feet thick, and as a rule the values are too low grade to mine. The east and west veins are in the form of stringer leads, consisting of a mass of quartz stringers cutting the schist, carrying more or less free gold and sulphurets.

The main footwall of the lode is serpentine with a hanging-wall of Calaveras slates. Ore shoots occur west of central vein with a trend toward the north. On the south end of the ore body a high-grade shoot of ore 100 feet long by 3 feet wide is encountered on the contact between the slates and serpentine. There are seven distinct ore shoots developed on this property, with average length of 200 feet and a width of 6 feet.

Work is carried on through a 3-compartment shaft (5′x 5′ each), 1650 feet deep, which is vertical to the 700-foot level, the remaining distance being sunk on 58° incline. Underground workings consist of drifts north and south on east and west veins on the following levels: 200′, 500′, 700′, 800′, 950′, 1100′, 1250′, and 1400′; total amount of underground drifts and crosscuts being 18,000 feet.

The veins are faulted on the south end of ore body between the 1200-foot level and the 1400-foot level, and on the north end between the 1100-foot level and the 1200-foot level; faulted 8 to 25 feet to the southwest, strike of fault being N. 35° W., dip 15° NE. Ore is mined by shrinkage system of stoping, with chutes at 20-foot intervals. Ore pockets are in hanging-wall of shaft, capacity being from 100 to 200 tons each.

Mine equipment: 300 h.p. double-drum electric hoist; 1100 cu. ft. and 800 cu. ft. Rix compressors, both electrically driven; auxiliary steam plant, consisting of three 100 h.p. boilers and 200 h.p. double-drum hoist. Ore hoisted in 2-ton skips and crushed by two 9″ x 16″ Blake crushers, driven by 75 h.p. motor. Ore hauled from bins at headframe a distance of 600 feet by 15 h.p. electric motor, hauling two 1½-ton cars.

Mill: 60-stamps, weighing 1200 pounds apiece, drop 7 inches, 100 drops per minute, crushing 5 tons per stamp, through 40-mesh. Stamps driven by two 75 h.p. motors. Pulp from batteries concentrated by twenty-four 6-foot Johnston vanners, driven by 35 h.p. motor. An extraction of 86% is made in mill. Concentrates assay $30 per ton. Force of 116 men employed. Harvard Mine (Inc.), 141 Milk street, Boston, Mass., owner. W. B. Buckminster, general manager; H. W. Gould, superintendent.

Hazel Dell Mines (quartz). (See Report XIII, p. 481.) They are 9 miles north of Soulsbyville, and consist of the Esterbrook, Evans and

Hazel Dell. Workings caved. William Sharwood, of Soulsbyville, owner.

Henrietta Mine (quartz). (See Report XII, p. 302). It is on the north fork of the Tuolumne River, 4 miles northeast of Tuolumne. C. F. Haslam, of Sonora, owner.

Hope Mine (quartz). It is on the Bonanza lead, ½ mile east of Sonora. The vein strikes N. 85° E. with a dip of 23° W. The footwall is a mica schist with a porphyry hanging-wall. Average width of vein is 2 feet. A tunnel has been driven across the mica-schist formation, cutting the vein 330 feet from the portal with a drift 200 feet east and 100 feet west on the vein. Total length of crosscut tunnel, 460 feet. At 93 feet above lower tunnel there is a crosscut tunnel 850 feet long, with a drift on vein 700 feet to the east and 150 feet west. Eight men are employed driving lower tunnel to crosscut footwall vein, also grading for a 5-stamp mill. Hope Mines Development Company, Boston Building, Salt Lake City, Utah, owner.

Imperial Mine (quartz). Situated 1 mile east of Jacksonville, on ridge west of Kanaka Creek, comprising the following group of claims: Imperial, Two Pardners, Miniokus, Rebate, Gladis L., The It, and Poodle Dog, area being 400 acres. Wide ore zone of mineralized slates cut by numerous veins and stringers of quartz, carrying gold values and auriferous pyrite. General course of vein is N. 45° W., dip 65° NE. The footwall is slate, and a hanging-wall of amphibolite schists. Developments consist of a shaft 216 feet deep, and a series of crosscut tunnels from 50 to 100 feet in length. Steam hoist and 10-stamp mill on property. Idle. Imperial Gold Mining Company, San Luis Obispo, owner.

Jumper and Golden Rule Mines (quartz). (See Report X, p. 50; MIN. RES. W. ROCKY MTS., 1871, p. 33, and 1872, p. 62; Bull. 18, p. 131,) Situated 4 miles south of Jamestown, near the town of Stent. The property comprises Jumper, New Era, Golden Rule, and Bogan Ranch (Agr. Pat.). In the Jumper mine the gold occurs in a dike accompanying the amphibolite schist and in small veins and stringers cutting the schist; width of zone varies from 5 to 50 feet. Ore is free milling with 2% pyrite and often the telluride, petzite occurs with free gold. This mine is different from other properties on the lode, in that it has no continuous ore shoots.

Noted for rich pockets of coarse gold found on west side of diorite dike which accompanies the vein. Course of vein N. 16° W., dip 70° NE. The footwall of the vein is a hard altered diorite and serpentine, with a diorite and diabase hanging-wall.

Property developed through three incline shafts to following depths: New Era shaft, 1400 feet; Golden Rule shaft, 500 feet; West Vein shaft, 200 feet. Winze from 1400-foot level of New Era workings sunk on vein to a depth of 400 feet; from the 493-foot level of Golden Rule workings, a winze sunk on a 70° incline on vein 800 feet deep. The underground workings on these properties are very extensive. Present work confined to sinking a shaft on the west vein, where a large low-grade body of ore has been developed. Property is equipped with air and electricity.

Mill: Two 10″ x 20″ Blake crushers, driven by 40 h.p. motor; 40-stamp mill, of which only 20 stamps are under operation, weight of stamps being 1000 pounds, dropping 100 drops per minute through 6 inches and crushing 3 tons per stamp. No concentrators are used, there being only two Union concentrators in mill, for testing purposes. Mill driven by 50 h.p. motor. Men employed, 28. Jumper California Gold Mines Company, 5 Rue Blanche, Paris, France, owner. L. S. Grant, general manager.

Kanaka Mine (quartz). (See Reports VIII, p. 669; XII, p. 303.) It is 5 miles northeast of Groveland. The course of vein is N. 10° E., dip 45° E. The formation is a hard black siliceous slate. Vein has an average width of 2 feet. Developments consist of four tunnels driven on vein. Main tunnel 1185 feet long. At 240 feet from mouth of tunnel a winze was sunk to a depth of 225 feet, and 700 feet south of first winze there is another winze 400 feet deep. There is a 10-stamp mill on the property. Idle. Mrs. Agnes Parr, of London, England, owner.

Keltz Mine (quartz). (See Reports VI (Part II), p. 59; X, p. 755; XI, p. 504; XII, p. 303.) It is 16 miles northeast of Columbia, in the canyon of the south fork of Stanislaus River. The course of vein is north and south, dip 45° E.; occurring in the slates and quartzites of the Calaveras formation. The mine has been opened up by a shaft 300 feet deep, and three tunnels driven on vein—1500 feet, 800 feet, and 400 feet. A 10-stamp mill is on the property. Idle. Keltz Mining Company, owner.

Kriss-Kross Mine (quartz). (See Report XII, p. 303.) It is a pocket mine 1 mile west of Priests. Idle. J. J. Hughes, of Chinese Camp, owner.

Lady Washington (see *United Mines.*)

La Guria Mine (quartz) is a prospect at Groveland. Shaft 125 feet deep. Idle. A. DeFerrari, of Groveland, owner.

Lamphere Mine (quartz). (See Report XI, p. 303.) It is at Confidence, adjoining the Confidence mine on the north. Shaft 480 feet deep. Caved. Richard Chute, of Sonora, owner.

Laura and North Star Mines (quartz). (See Reports XI, p. 498; XII, p. 303.) Situated 1 mile north of Tuolumne, on ridge east of Cherokee Creek. On the Eureka-Dead Horse lead in mica schist. Course of vein N. 35° W., dip 50° NE. and has an average width of 5 feet. Developments consist of two shafts—Laura shaft, 436 feet; North Star shaft, 400 feet deep. The quartz is free milling with a small percentage of pyrite and galena. Idle. T. M. Ashton, of Tacoma, Wash., owner.

Lead Mine (quartz). (See Report X, p. 56.) It is ½ mile west of Tuttletown. The pay rock is found in a mass of ankerite and mariposite between walls of amphibolite schist. Shaft 150 feet deep. Idle. W. B. Clement, of Tuttletown, owner.

Lewis Mine (quartz) is a pocket mine 2 miles north of Sonora, on the west slope of Bald Mountain. The course of the vein is N. 60° E., dip 65° NW., with width of 8 inches to 2 feet. Developments consist of a shaft 200 feet deep and four tunnels driven on vein, the lowest tunnel being 1200 feet in length. Two men are employed. William M. Lewis, of Sonora, owner.

Longfellow Mine (quartz). (See Reports VIII, p. 672; XI, p. 494.) At Big Oak Flat, adjoins the Mack Mine on the west. The formation is slate. There are two veins 50 feet apart, the footwall vein being 10 feet wide, and the hanging-wall vein 5 feet in width. The course of the veins is east and west, with dip 30° N. Shaft sunk on vein to a depth of 900 feet, with levels at every 100 feet. The ore shoots trend to the east. Ore free milling, containing coarse gold with 1% pyrite. There is a hoist, compressor and 25-stamp mill on the property. Two men employed keeping out the water. Longfellow Gold Mining Company, First National Bank Building, Monterey, owner.

Los Angeles Mine (quartz) is 6 miles south of Tuolumne, on ridge east of Tuolumne River. An east and west vein, with a dip of 80° N. in Calaveras formation. Average width of vein, 4 feet. Developments consist of three tunnels and a shaft 150 feet deep on vein. A lower tunnel has been driven on vein 500 feet. At a vertical distance of 350 feet above lower tunnel there is a tunnel 150 feet in length on vein, and 250 feet above the latter is still another 175 feet long. A 5-stamp mill on property. Idle. J. S. Kuns, of Los Angeles, owner.

Louisiana Mine (quartz) is 2 miles northwest of Tuolumne, on the Tuolumne and Soulsbyville road, comprising the following claims: Louisiana, Parker and Mason, and Lebiation; total area, 50 acres. The average width of vein is 18 inches; in granodiorite. Course of vein is N. 15° E., dip 70° SE. The ore is base, containing free gold associated with pyrrhotite, marcasite, sphalerite and galena. Developments consist of a shaft sunk on vein to a depth of 520 feet, with drifts north and south on 100′, 133′, 208′, 295′, and 417′ levels. A series of diorite dikes cuts the vein, with widths of 6 inches to 12 inches. Two ore shoots developed, the shoot north of shaft 100 feet long, that to south of shaft 180 feet long; both have an average width of 18 inches. Nine men employed sinking shaft. Louisiana Development Company, 606 Electric Building, Cleveland, Ohio, owner; Clarence Woods, manager.

Lucky Boy Mine (quartz) is 6 miles south of Tuolumne, on north fork of the Tuolumne River. Course of vein northeast and southeast, dip 80° SE. Average width of vein, 18 inches, with a limestone hanging-wall and slate footwall. Two tunnels driven on vein, 125 feet and 100 feet in length. Idle. C. F. Stucki, of Groveland, owner.

Lumsen Mine (quartz). (See Reports XI, p. 494; and XII, p. 303.) Idle. D. Lumsen & Son, of Big Oak Flat, owners.

Mack Mine (quartz). At Big Oak Flat, comprises the Mack, Wooden, Two Brothers, and Little Sisters. The course of vein is east and west, dip 36° N. Partly in the quartz-diorite and mica schist formations. The vein averages about 5 feet in width. To the east of New Mack shaft both walls of the vein are in the quartz-diorite, while to the west the vein is in slate. There are two parallel veins on the property, but most of the work has been on the Mack-Longfellow vein. The New Mack shaft has been sunk to a depth of 700 feet on the vein, and is 270 feet east of Old Mack shaft, which is 450 feet deep. Drifts have been driven on the vein every 100 feet to the 600-foot level. The ore is free milling, containing about 1% pyrite and some galena, and occurs in lenses. Below the 600-foot level the vein is in slate. Ore raised from new shaft by 50 h.p. hoist, driven by air. The air for drills and hoist is furnished by 6-drill 2-stage Llewellyn Iron Works compressor, driven by 100 h.p. motor. Ore trammed from ore bins to mill, where broken by two 10″ x 20″ Blake crushers. From crushers, fed by Challenge ore feeders to 20 stamps, weighing 1000 pounds per stamp, dropping 6 inches, 100 drops per minute, and crushing 3 tons per stamp through 40-mesh. Pulp from batteries treated by four 6-foot Frue vanners. Mill driven by 75 h.p. motor. Electric power furnished by Pacific Gas and Electric Company. Seven men employed. Big Casino Gold Mining Company, Call Building, San Francisco, owner.

Mangante Mine (quartz) is situated at Jamestown, on ridge northeast of Woods Creek, on vein east of main Mother Lode vein. Course of vein N. 10° W., dip 65° NE., averaging 5 feet in width. Shaft 150 feet deep. Steam hoist and compressor on property. Idle. Central Mother Lode Mining Company, 401 J street, Sacramento, owner. J. P. Mangante, agent.

Mascot Mine (quartz). Prospect, ½ mile south of Jamestown, on vein east of Mother Lode vein. Shaft 45 feet deep. Two men employed sinking shaft. D. L. Mann, of Jamestown, owner.

Mayflower Mine (quartz). (See Report XIII, p. 491.) It is ½ mile southeast of Tuolumne, on ridge west of north fork of the Tuolumne

River, and comprises the following claims: Mayflower, Lena Belle, Mohican, Young America, Georgia, Buckeye. There are three crosscut tunnels on property to vein (lower tunnel 527 feet long, crosscutting vein 300 feet from portal), with a drift south 1300 feet and north 300 feet. At a distance of 125 feet from mouth, a drift was run 580 feet south and 100 feet north on a parallel fissure. Course of vein is N. 35° E., dip 60° SE. Formation is a mica schist. Idle. W. H. Scott, of Tuolumne, owner.

Mazeppa Mine (quartz). (See Report XI, p. 509.) It is 1 mile southeast of Stent. Vein is 5 to 20 feet wide in Calaveras slates. The footwall is serpentine and hanging-wall slate. Course of vein is N. 16° W., dip 65° NE. Incline shaft 800 feet deep sunk on vein. Compressor, electric hoist and 10-stamp mill on property. Idle. Frank B. Keever, Sharon Building, San Francisco, owner.

McAlpine Mine (quartz). (See Report X, pp. 43, 44.) It is 4 miles northwest of Coulterville. Idle. McAlpine Gold Mining and Milling Company, 820 Foxcroft Building, San Francisco, owner.

Miracle Mine (quartz) is a prospect west of Groveland, on east and west vein in slate formation. Shaft 100 feet deep; tunnel 160 feet long. Idle. J. B. DeMartini, of Groveland, owner.

Moccasin and Golden Key Group of Mines. Situated 9 miles southeast of Jacksonville, on Jackass Creek. Course of vein N 45° W., dip 65° NE. The vein has an average width of 5 feet, with serpentine footwall and a meta-diabase hanging-wall. Developments consist of a tunnel 1400 feet long driven on vein. Five men employed. Moccasin Consolidated Gold Mining Company, 626 Hearst Building, San Francisco, owner. Joe Penrose, superintendent.

Mohican Mine (quartz). Situated 8 miles south of Tuolumne, in canyon of the Tuolumne River. Comprises the following claims: Lilian No. 1, Lilian No. 2, Oakland, North Star, Golden Eagle; area 97 acres. The general formation is a mica schist. The course of the vein is N. 30° W., with a dip of 25° NE.; and has average width of two feet. Six tunnels have been driven on the vein to the south as follows: 900-foot tunnel level, 540 feet; 931-foot tunnel level, 1162 feet; 981-foot tunnel level, 312 feet; 1016-foot tunnel level, 1125 feet; 1161-foot tunnel level, 236 feet; 1200-foot tunnel level, 100 feet. On the 931-foot tunnel level there is a winze sunk on the vein 525 feet deep, at a distance of 400 feet from portal of the tunnel. The ore is free milling, with only a small percentage of pyrite. Ore forms in lens-shaped ore bodies. There is a 5-stamp mill on the property. Two men are employed prospecting the ground. Mohican Milling and Mining Company, 401 Alaska Commercial Building, San Francisco, owner. R. E. McHale, agent.

Moody Mine (quartz). At Big Oak Flat on Longfellow vein. Shaft 240 feet deep. Idle. W. A. Nevills Estate, owner.

Mormon Mine (quartz). At Big Oak Flat, on ridge south of Rattlesnake Creek. Two tunnels on vein 100 feet, 200 feet in length. Idle. G. B. Musante, of Big Oak Flat, owner.

Mount Jefferson Mine (quartz). (See Report XII, p. 304.) It is at Groveland, and in mica schist. The course of vein is N. 75° E., dip 75° NW. East shaft is 600 feet deep, west shaft 300 feet. Vein drifted on east and west on 100′, 200′, 300′, 400′, and 500′ levels. There is a 20-stamp mill on property. Idle. Mount Jefferson Mining and Exploration Company, Humboldt Bank Building, San Francisco, owner.

Mount Vernon Mine (quartz) is 2½ miles northeast of Confidence. There are four crosscut tunnels to the vein. Idle. Fred Sutton, of Sonora, owner.

Never-Sweat Mine (quartz). (See Report XII, p. 304.) It is 1 mile northeast of Priests. Tunnel 300 feet long. Idle. James Ballentine, of Big Oak Flat, owner.

New Albany (see *United Mines*).

Nonpareil Mine (quartz). Is 1 mile west of Groveland, on a stringer lead 40 feet in width, consisting of a mass of quartz stringers cutting schists. The course of vein is due east and west, with a dip 65° N. Development includes a shaft 250 feet deep. Crosscut tunnel 700 feet long connects with shaft at 250-foot level. There is a 10-stamp mill on property. Idle. George Smith, H street, San Francisco, owner.

Norwegian Mine (quartz). Situated ½ mile southeast of Melones, on the north slope of Jackass Hill. Worked as a pocket mine. Course of vein is N. 12° W., with a dip of 54° E., and an average width of 4 inches, occurring in hard amphibolite schist, being tightly frozen to the walls. Work carried on through an incline shaft, 550 feet deep. Two men employed mining a high-grade streak. The ore extracted from this mine is noted for its rich tellurides. Norwegian Consolidated Mining Company, Pacific Building, San Francisco, owner. H. A. Homline, agent.

O'Donnell Mine (quartz). Prospect, 1 mile south of Jamestown, on ridge east of Woods Creek. Crosscut tunnel 450 feet long. Shaft 30 feet deep. A 5-stamp mill on property. Idle. E. R. Elliott, of Modesto, owner.

O'Hara Mine (quartz). It is 1 mile north of Sonora, on the west of Woods Creek. Has limestone footwall with mica schist hanging-wall. The course of vein is N. 85° E., dip 15° NW.; width 8 to 18 inches. Shaft sunk on vein 800 feet. Idle. J. F. O'Hara, of Sonora, owner.

O. K. Mine (quartz). (See Report XI, p. 508.) It is 3 miles northwest of Jamestown, adjoining the Tarantula mine on northwest. Vein 4 feet wide, having Calaveras slate hanging-wall and a diabase footwall. Course of vein N. 35° W., dip 42° SW. Crosscut tunnel 380 feet long intersects vein 140 feet below outcrop of vein. Drifted on vein 140 feet south and 200 feet north. Several shallow shafts sunk on vein. Four men are employed driving north drift. Under lease to B. H. Wood. Chas. H. Segerstrom, of Sonora, owner.

Old Dominion Mine (quartz). Situated 1½ miles northwest of Columbia, occurs in slates of Calaveras formation, on an east and west vein, dipping 65° N. Developments consist of shaft 70 feet deep and two tunnels, 240 and 110 feet in length. A 2-stamp mill on property. Five men employed. G. F. Grant, of Columbia, owner.

Old Tuolumne Mine (quartz). (See Report XII, p. 305.) On the south fork of Stanislaus River, 4 miles north of Columbia. Idle. Levy Bros., of San Francisco, owners.

Omega Mine (quartz). It is 2 miles northwest of Jamestown, on the north slope of Table Mountain. The vein occurs between the serpentine on the west and Calaveras slates on the east. The course of vein is N. 35° W., dip 62° NE. The vein material is quartz, dolomite and mariposite, showing free gold and 2% pyrite. Incline shaft 630 feet deep in footwall of vein. On 127-foot level crosscut 100 feet east to vein and a drift 500 feet south on vein. On 307-foot level the vein was cut 120 feet east of shaft and a drift driven 200 feet south. On the 457-foot level, crosscut intersects vein 160 feet east of shaft, and there is a drift on the vein 175 feet south. Mine equipment consists of steam hoist and 4-drill Leyner compressor.

Mill: A 9″ x 16″ Blake crusher, 20-stamp mill, 1050-pound stamps, eight 6-foot Frue vanners. Mill driven by 60 h.p. motor. Idle. C. W. Ayers, Mathew Harter, owners, Taft, Kern County.

Ophir Mine (quartz). (See Report XII, p. 305.) One mile north of Big Oak Flat. Idle. James Bros., of Groveland, owners.

Patterson Mine (quartz). (See Reports VIII, p. 656, and X, p. 56.) It is ½ mile north of Tuttletown, on southwest slope of Jackass Hill. The course of vein is N. 35° W., with a dip of 65° NE., average width 5 feet. Work was carried on through an incline shaft 820 feet deep, and through a crosscut tunnel 1250 feet long, which intersected the shaft at vertical depth of 85 feet from the surface. Workings consist of seven levels 100 feet apart, and the vein was drifted on both north and south of shaft. Two shoots of ore developed, having an average width of 5 feet. Idle. Chas. Fitzgerald, William McCrim et al., of Jamestown, owners.

Peña Blanca Mines (quartz). (See Report XIII, p. 488.) They are
½ miles west of the Rawhide mine. Idle. Dr. J. L. Ross et al., of
edwood City, owners.

Providence Mine (quartz). (See Bull. 18, p. 138, by W. H. Storms.)
his property is 2½ miles southeast of Tuolumne, in the canyon of the
orth fork of Tuolumne River. Comprises 90 acres, including the
llowing claims: Providence, Good Enough, Consuello, East Consuello,
nd East Providence. The vein occurs in the black Calaveras slates
ear the surface, but in depth has a black slate on footwall with a
ranodiorite and limestone hanging. The vein has an average width
f 5 feet. Course of vein is N. 8° E., dip 45° E. Two parallel
eins on property. From the surface to the 700-foot level all drifts
orth and south of shaft are on the footwall vein, while from the
00-foot level to the 1100-foot level they are on the hanging-wall vein.
he ore is free milling, with 2% pyrite and galena. Developments con-
st of a shaft 1300 feet deep, sunk on the footwall vein, with levels at
very 100 feet from collar of shaft, and drifts north and south on
ein. Water supply to run mill and hoist is brought from Duck Wall
reek in 2½ miles of ditch; capacity of ditch, 100 miner's inches, with
50-foot head at mill.

Mill: 10″ x 20″ Blake crusher, 10 stamps, weighing 1050 pounds per
amp, dropping 6 inches, 100 drops per minute, crushing 3 tons per
amp through 40-mesh screen; pulp from batteries treated by two
Vilfley tables. Concentrates run $90 to $100 per ton. Twelve men
mployed. New Providence Gold Mining Company, 2041 Emerson
reet, Berkeley, owner. J. F. Chapman, superintendent.

Puerto-Fino Mine (quartz). (See Report XII, p. 499.) It is ½ mile
orthwest of Tuolumne. Idle. William Sharwood of Soulsbyville,
wner.

Rappahannock Mine (quartz). (See Report XII, p. 306.) Situated
miles northwest of Jamestown, adjoining the Rawhide mine on the
orthwest. An incline shaft was sunk to a depth of 1150 feet in the ser-
entine footwall. Crosscuts were run from the shaft to vein on 350-foot
evel a distance of 250 feet east. On 600-foot level a crosscut was
riven east 140 feet to vein, and east into slate hanging-wall an addi-
ional distance of 100 feet. On 1100-foot level a drift was driven 295
eet east, crosscutting vein and hanging-wall slates. Course of vein is
. 35° W., dip 65° NE., average width of vein material being 20 feet.
here are boilers and large steam hoist on property. Idle. Richard
hute, of Sonora, owner.

Rawhide Mine (quartz). (See Reports X, p. 54; XI, p. 507; XII,
. 306.) Situated 2 miles northwest of Jamestown, to the north of Table
ountain. The main vein occurs on the contact between the serpentine

on the west and Calaveras slates on the east, and is about 70 feet wide. It strikes N. 34° W. and dips 62° NE. The slates dip 75° NE. This vein is composed of dolomite, quartz and mariposite. The vein that was worked lies on footwall side of main vein, being separated from it by a thin gouge. This vein had an average width of 20 feet. The ore shows free gold and pyrite in a gangue of quartz, dolomite and mariposite.

South shaft or main working shaft was sunk on vein to a depth of 2000 feet on a 62° incline. About 1000 feet north of south shaft there is an incline shaft on vein 400 feet deep. Levels were driven on vein north and south every 100 feet. The underground workings consist of many miles of drifts. Ore shoots had a northerly trend. There is a large steam hoist and 40-stamp mill on the property. North shaft is now being unwatered, preparatory to making an examination of the property. The gold production from the Rawhide mine is reported to have been $6,000,000. Six men employed. T. W. Patterson Estate of Fresno, owner. Alexander Chalmers, of Angels, agent.

Rawhide No. 2 Mine (quartz). Is first claim south of Rawhide mine. Idle. A. Hayward Estate, San Francisco, owner.

Red Jacket Mine (quartz). Is 1 mile east of Big Oak Flat, on the Mississippi-Eureka vein. Three tunnels have been driven on vein. Idle. V. J. Repetto, of Big Oak Flat, owner.

Republican Mine (quartz). (See Report X, p. 47.) It is ½ mile northwest of Jacksonville, on Woods Creek, comprising the Mammoth, Orcutt, Republican, Harrison, and White Oak claims. Three veins have been developed on the property—footwall, hanging, and central or boulder vein. A broad mineralized zone, consisting of veins or lenses of quartz cutting the schists; course of veins N. 40° W., dip 65° NE. Developments consist of an incline shaft 700 feet deep on the Republican claim, with levels at 200′, 300′, 400′, and 600′. The principal ore shoot developed was 500 feet long, with an average width of 12 feet. On the Mammoth claim a crosscut tunnel was driven 750 feet through the footwall country to vein, and drifts 150 feet north and 350 feet south. From tunnel level a winze 430 feet deep was sunk in the gouge on hangingwall of the boulder vein. Course of vein N. 45° W., dip 65° NE. The vein has a greenstone hanging and a slate footwall. About 200 feet above Mammoth tunnel there is a crosscut tunnel 500 feet to vein, which is connected with lower tunnel by a raise.

Mine equipment: At Republican shaft, 80 h.p. boiler, double-drum steam hoist, 12″ x 16″ compressor. There is a 20-stamp mill at the mouth of Mammoth tunnel. Idle. Republican Mining and Development Company, Mills Building, San Francisco, owner. F. F. McGovern, of Sonora, agent.

Rising Sun Mine (quartz). (See Reports X, p. 748, and XI, p. 502.) It is on Turn Back Creek, 3 miles northeast of Tuolumne. The course of vein is N. 18° E., dip 45° E. The vein has an average width of 12 inches. Hanging-wall is highly mineralized clay slate, with a footwall of siliceous slates. Upper tunnel 250 feet in length on vein. Lower tunnel driven across the formation 300 feet. Incline shaft 420 feet deep. There is a 5-stamp mill on property. Idle. William Mansfield, of Tuolumne, owner.

Riverside Mine (quartz). It is 11 miles northeast of Columbia, on the south fork of Stanislaus River. The vein occurs in siliceous schist of the Calaveras formation. The course is N. 30° W., dipping 58° NE., with average width of 5 feet. It was worked through four tunnels, the lower one being a crosscut 700 feet to vein with a drift northwest 1500 feet. Property idle; has not been worked for years. Edgar H. Williams et al., of San Francisco, owners.

San Guiseppe Mine (quartz). (See Reports VIII, p. 654; X, p. 749; XII, p. 306.) It is 1 mile west of Sonora. The vein occurs in amphibolite schist. Shaft 250 feet deep. Idle. Fred Sutton, of Sonora, owner.

Santa Ysabel Mine (quartz). (See Reports X, p. 51, and XII, p. 304.) Situated 2½ miles south of Jamestown, on southeast slope of Quartz Mountain. Controls the following claims: Knox and Boyle, Gray Eagle, Miller and Holmes, and Nyman, comprising 100 acres. General formation is amphibolite schist, ore being found on both sides of the main dolomite and talcose vein, in the form of numerous stringers cutting the Calaveras slates. A series of small greenstone dikes accompanies the vein. Average width of vein is about 6 feet; course N. 16° W., dip 65° NE. Mine developed by three incline shafts. No. 1 shaft is 830 feet deep, sunk in slate hanging-wall; three levels—400′, 600′ and 800′. On the 400-foot level, crosscut east to vein 200 feet, and drift south 500 feet; on 600-foot level, crosscut west 400 feet with a drift north 40 feet, no ore developed. No. 2 shaft, 600 feet south of No. 1, has a depth of 600 feet, cut vein at 400 feet; Knox and Boyle shaft sunk east of central (east) vein to a depth of 800 feet. Ore is free milling, containing 3% pyrite.

Mine equipment: 200 h.p. double-drum hoist, 15″ x 18″ Giant Duplex compressor. Electrically driven. Mill: 10″ x 20″ Blake crusher, 40-stamp mill, 1000-pound stamps, four 6-foot Frue vanners; driven by 75 h.p. motor. Idle. Santa Ysabel Mining and Milling Company, Boston, Mass., owner. C. E. Shafer, of Jamestown, agent.

Sell Mine (quartz). Situated 1 mile north of Sonora, on northwest slope of Bald Mountain. Worked as a pocket mine. Ore occurs in rich pockets on intersection of east and west crossing dikes with vein. The course of vein is north and south with a dip of 85° W. Tunnel driven on vein 1400 feet long. Two men employed. J. A. Sell, W. M. Sell et al., of Sonora, owners.

Seminole Mine (quartz). (See Report XIII, p. 491.) Situated ½ mile southeast of Tuolumne, on ridge west of north fork of the Tuolumne River. The vein has an average width of 3 feet, with a strike N. 35° E., dip 60° SE., cutting through a mica schist. The ore is free milling, with auriferous pyrite and galena. An incline shaft has been sunk on the vein to a depth of 336 feet, with levels at 85′, 151′ and 318′, from collar of shaft. Idle. Seminole Consolidated Gold Mining Company, 8 Queen street, Sheepside, London, England, owner. W. H. Scott, agent.

Silken Mine (quartz). (See Report XII, p. 306.) It is 1 mile northeast of Priests Hill. Idle. C. P. Hale, of Big Oak Flat, owner.

Snell Mine (quartz). (See Report XI, p. 505.) It is between Rose Creek and the Stanislaus River, 7 miles east of Murphy and 13 miles north of Columbia. There are two shafts, 100 and 150 feet deep. Idle. Col. Dorsey Estate, of San Francisco, owner.

Sonnet Mine (quartz). Located on Grant Ridge, 12 miles northeast of Columbia. The course of vein is N. 78° E., and dipping 70° SE., in the slates of the Calaveras formation. The ore shoots form on intersection of vein with north and south crossings. The character of the ore is a heavy sulphide containing free gold associated with the sulphides of iron, zinc and lead. The quartz carries as high as 5% sulphides. Average width of vein is 2 feet. Tunnel driven on vein 600 feet. At 260 feet from mouth of tunnel a winze has been sunk to a depth of 100 feet. At 150 feet from portal of tunnel a crosscut has been driven 100 feet north to a parallel vein, and a drift run 150 feet east and 150 feet west. There is a 5-stamp mill on property driven by 15 h.p. gasoline engine. Seven men are employed. R. C. Davis et al., of Columbia, owners.

Soulsby Mines (quartz). (See Reports VI (Part II), p. 59; X, p. 742; XII, p. 306.) They are at Soulsbyville, and comprise the Churchill, Johnson & Bradbury, Pennsylvania, Platt & Gilson and Soulsby mines. The formations are granodiorite and mica schist, with intrusive dikes of diorite. Two parallel veins on property, having a course of N. 15° E., and a dip of 68° E. The quartz carries quite a large percentage of sulphides of iron, copper, lead and zinc, containing gold. The veins have an average width of 2 feet. Three shafts were sunk on vein to the following depths: Davidson 700 feet, Central 850 feet, Pennsylvania 800 feet, vertical. Hoists, pumps, compressors and 20-stamp mill on the property. Idle. Bagdad-Chase Gold Mining Company, of Rochester, N. Y., owner.

Star Mine (quartz). It is 2 miles northeast of Columbia, on ridge south of Rose Creek. The course of vein is northeast and southwest, dip 45° SE., with average width of 2 feet. Work was carried on through a shaft 500 feet deep. The quartz is dark in color, being heavily sulphuretted, carrying sulphides of iron, lead and zinc, and coarse gold. There is a steam hoist, compressor and a 10-stamp mill on the property. Idle. E. A. Hayes, of San Jose, owner.

Starr King Mine (quartz). Situated 4 miles southeast of Tuolumne, adjoining the Providence mine on the south. The vein has an average width of 18 inches, with a slate footwall and a granodiorite hanging. The strike of vein is N. 35° E., dip 35° SE. Developments consist of an incline shaft on the vein to a depth of 496 feet. There is an electric hoist, compressor and 5-stamp mill on the property. Idle. Donald C. Kennedy, 545–553 Golden Gate avenue, San Francisco, owner.

Stonewall (Pedro) Mine (quartz). It is a pocket mine, situated 1 mile north of Sonora, on west slope of Bald Mountain. Series of shafts and tunnels on veins. Formation is a mica schist. Idle. William Pedro, of Sonora, owner.

Street Mine (quartz) is ½ mile north of Tuttletown, near Jackson Flat. Incline shaft sunk on vein to a depth of 300 feet. On 200-foot level, drift north 200 feet; on 300-foot level, drift north 900 feet. Steam hoist and 5-stamp mill on property. Idle. Richard Kinsman, 991 Sixty-first street, Oakland, owner.

Stuart and Morris Mine (quartz) is 1½ miles north of Sonora, on west slope of Bald Mountain. Stuart tunnel 500 feet long, Morris tunnel 900 feet in length, and three incline shafts from 200 to 500 feet deep. The course of vein is northeast and southwest, dip 10° NW., occurring in mica schist. Three men employed. Helen Wainwright, Frank Tomisson et al., of Sonora, owners.

Sugarman and Nigger Mines (quartz). (See Report X, p. 737.) Situated on the west slope of Bald Mountain, 2 miles north of Sonora. It is a pocket mine in mica schist of the Calaveras formation. The vein has a course of N. 57° E., and dip 60° NW. Two tunnels on the vein; lower tunnel 1800 feet in length, and 80 feet above it another one 500 feet long. The ore shoots or pockets occur near east and west granite crossings, which reefs are from 8 to 60 feet wide and dip to the south. Rich pockets are formed at the point where these crossings come in contact with the vein in a belt of black slate, also with quartz stringer feeders having same course as vein, but dipping faster into the main vein near a crossing. The quartz is free milling, containing coarse gold associated with tellurides of gold and silver. Two men are employed. C. F. Smith and C. R. Watson et al., of Sonora, owners

Tanzy Mine (quartz) is ½ mile east of Sonora, on the northwest slope of Bald Mountain. The course of vein is N. 35° W., dip 23° NW. Footwall is limestone and hanging-wall slate. Porphyry dike accompanies vein on hanging-wall side. Shaft 500 feet deep sunk on vein. Two men employed. J. F. O'Hara, of Sonora, owner.

Tarantula Mine (quartz). It is 3 miles northwest of Jamestown, adjoining the Alameda mine on the northwest. The vein is in the form of a mass of quartz stringers cutting the schist, having a width of 20 feet; course northwest and southeast with a dip of 65° NE. The footwall is serpentine and hanging-wall Calaveras slates. There is an incline shaft 900 feet deep on vein. Caved. Idle. Tarantula Gold Mining Company, H. W. Peabody & Company, 225 California street, San Francisco, owners.

Tarantula Mine (quartz). It is 2 miles northwest of Jacksonville, on Woods Creek, to the north of the Eagle-Shawmut mine, comprising the following claims: Tarantula, Omega, Western Extension, and Tarantula Hawk, area 60 acres, giving 1829 feet on the lode. Stringer ore deposit on the main Mother Lode belt, consisting of east, boulder, and west veins, in a belt of Calaveras slates, having a serpentine footwall with a slate hanging-wall. Ores are free milling, containing 2% auriferous pyrite. Course of veins N. 45° W., dip 65° NE. Heavy black slate gouge on hanging-wall of vein. Developments consist of crosscut tunnel 900 feet long, and three compartment winze sunk from tunnel level on vein to a depth of 640 feet with drifts driven north and south every 100 feet below tunnel. There are also fourteen tunnels on veins with a total amount of workings of 3124 feet.

Mine equipment: 100 h.p. direct-driven electric hoist; 10-drill compressor driven by 100 h.p. motor. Mill: No. 4 Kennedy gyratory crusher, driven by 25 h.p. motor, 20-stamp mill, 1250-pound stamps, driven by 75 h.p. motor, four 6-foot Frue vanners, and four Wilfley tables, driven by 15 h.p. motor. Idle. United Gold Mining and Milling Company, 13 bix Rue des Matherius, Paris, France, owner. J. Boue, secretary.

Trio Mine (quartz). (See Report X, p. 53.) It is 1¼ miles northwest of Jamestown. Idle. A. Hayward Estate, San Francisco, owner.

U. S. Grant Mine (quartz). It is 12 miles northeast of Columbia, on Grant Ridge. Developments consist of a crosscut tunnel 1000 feet long to vein and a shaft 96 feet deep. The formation is a mica schist. Vein averages 12 inches in width. Idle. Lake Superior and Nevada Development Company, 218 W. Superior street, Duluth, Minn., owner.

United Mines Group (quartz). (See Reports VIII, p. 665; X, p. 752; XI, p. 497; XII, p. 304.) Comprises the following claims: Eureka, Dead Horse, Lady Washington, Grizzly, North Albany, New Albany, Side

Viper; total area being 400 acres. Workings consist of New Albany ncline shaft 1050 feet, Dead Horse shaft 1800 feet, Grizzly shaft 1000 eet, Old Albany shaft 500 feet, Lady Washington upper tunnel 500 eet on vein, lower tunnel is a 2000-foot crosscut tunnel connected with Dead Horse shaft.

Operations are being carried on through the New Albany shaft, which is on a vein east of and parallel to the Dead Horse lead. Course of vein is N. 35° W., dip 55° NE. The vein has an average width of 5 feet. The footwall is a black plumbago slate and the hanging-wall granodiorite. The country rock is a mica schist. The Dead Horse ead was extensively worked through tunnels on Lady Washington and through shafts on Grizzly and Dead Horse claims. The ore is free milling, with 1% pyrite and traces of galena. The ore forms in lenses at the intersection of cross diorite dikes with vein. There is a slate casing between vein and hanging-wall of granodiorite. Two shoots of ore are developed, one north of shaft and the other to the south, having a length of 300 feet with an average width of 3 feet. Work is carried on through a crosscut tunnel 200 feet to vein, from which point a winze has been sunk on vein to the 700-foot level, and 600 feet south of this winze there is a winze 300 feet deep to 1000-foot level. The vein on this level has been driven on 125 feet south and a shoot of good ore developed. The underground workings show extensive amount of drifts, crosscuts and raises. The company owns the water rights on the north fork of the Tuolumne River. A ditch 8 miles long delivers water to mill and power plant with a head of 600 feet.

An Ingersoll-Rand compressor (22½″x 14″) (14″x 14″) furnishes air for hoists and air drills. Ore from tunnel delivered to mill over an incline tramway 500 feet in length in two 1-ton cars. Mill: 9″ x 15″ Blake crusher, 20 stamps weighing 1050 pounds per stamp and dropping 6 inches, 95 drops per minute, crushing 3 tons per stamp through 40-mesh screen; pulp from batteries to four 4-foot Frue vanners. The old company made an attempt to cyanide the ore, but without success; there is a 50-ton cyanide plant on property, consisting of a Dorr classifier, two Hardinge mills, two Dorr continuous slime thickeners, four Pachuca tanks, and solution tanks. Concentrates assay $25 per ton, and are shipped to Selby Smelting Works.

Property under lease to Paul Morris, of Tuolumne. Eleven men are employed. United Mines Corporation, 606 Electric Building, Cleveland, O., owner. Paul Morris, manager.

Vine Spring Mine (quartz). Situated 2 miles northwest of Columbia, on ridge east of the Stanislaus River. The formation is granodiorite. The course of vein is northwest and southeast with a dip of 60° NE., and an average width of 18 inches. Three tunnels have been driven on vein. Idle. S. Whetmore, J. V. Bannister et al., of Columbia, owners.

Wheal Ruff Mine (quartz) is 1 mile west of Soulsbyville, on Sonora and Mono road. On an east and west vein in the granodiorite. Vein dips 80° S. There is a vertical shaft 200 feet deep. Property under lease and bond to Tuolumne Syndicate, who are sinking the shaft. A 30 h.p. single-drum electric hoist and (16″ x 14″) (10″ x 14″) Ingersoll-Rand compressor on property. Thirteen men are employed. Thomas Richards and James Burns, of Soulsbyville, owners. R. C. Knox, superintendent.

Willietta Mine (quartz). (See Report X, p. 47.) It is a mile southeast of Jacksonville. Owned in Scotland. William Sharwood, of Soulsbyville, agent.

Wise Mine (quartz). It is ½ mile south of Tuttletown, on the southeast slope of Jackass Hill. The vein is in form of an irregular system of quartz stringers cutting the amphibolite schists, forming pockets at intersection of vertical stringers with stringers of slight dip. Course of vein N. 35° W., dip 65° NE. Tunnel driven on vein a distance of 375 feet. Four men employed. Stephen Davey and A. A. Swerer, of Tuttletown, owners.

GOLD MINES—PLACER.

Buckeye Channel (*Rosedale*) *Mine* (drift). It is 3 miles north of Jamestown, on the east slope of Table Mountain. On the Rosedale channel, having a course northeast and southwest. The bedrock is a soft Calaveras slate. The width of gravel is 60 feet, with a depth of 3 feet. The gravel is worked through incline shaft 325 feet deep. Twelve men are employed drifting on channel. W. F. Wilson, of San Francisco, owner.

Cherokee Gravel Mine (drift). Situated 1½ miles north of Tuolumne, on ridge west of Turnback Creek. Course of channel is northwest and southeast and is capped by andesite flow 400 feet thick. The bedrock is a decomposed granodiorite. Tunnel 400 feet long. Two men are employed retimbering tunnel. Cherokee Gravel and Gold Mining Company, Soulsbyville, owner. Andrew Scanavino, superintendent.

Columbia Basin Mine (drift). Situated ½ mile north of Columbia, in Columbia basin. On the Table Mountain channel. The course of channel is northwest and southeast, the gravel occurring in deep crevices of the limestone formation. The gravels are subangular, little worn and largely quartzose. Shaft 200 feet deep. Three men are employed unwatering mine. Columbia Basin Development Company, 652 Monadnock Building, San Francisco, owner.

Crawford Placer (hydraulic). Situated 1 mile northeast of Columbia, on Yankee Hill. Controls 420 acres on Woods Creek. Course of channel is northeast and southwest, having a depth of gravel of 10 to 80 feet, with a width of 2000 feet. T. C. Crawford, of London, England, owner.

Gold Ship Gravel Mine (drift). Situated 5 miles northeast of Groveland, on ridge north of Humbug Creek. Gravel capped by an andesitic breccia. The gravel is slightly cemented, containing boulders of andesite, quartz, quartzite and slate. Developments consist of an incline shaft 625 feet deep on west rim of channel; on the east rim a shaft was sunk on an incline to a depth of 150 feet. There is a Dodge rotary mill on property. Idle. Gold Ship Mining Company, Ray Building, San Jose, owner. W. J. Graham, manager.

Humbug Gravel Mine (drift). Situated 2 miles north of Jamestown, on the east slope of Table Mountain, on the Table Mountain channel. The channel is capped by basaltic flow 200 feet in thickness. Work is in progress on this property developing the Humbug and Rosedale channels. The Rosedale channel has an elevation of 12 feet above the Humbug channel and spills into the latter. These channels are developed through two incline shafts with depths of 365 and 325 feet. There is a drift 1676 feet long connecting the incline shafts. The course of channels is northeast and southwest. The width of gravel on Humbug channel is 200 feet, with a depth of 3 to 5 feet. The Rosedale channel has a width of 60 feet, with a depth of gravel of 5 feet. The bedrock is a soft slate. The gravel is cemented and free, composed of quartz, quartzite and andesitic boulders. There is an extensive amount of underground workings on the two channels. Six men are employed. California Company, 60 State street, Boston, Mass., owner. J. L. Whitney, manager.

Punchbowl Gravel Mine (drift). Situated 6 miles west of Jamestown, on southwest slope of Table Mountain. The course of channel is north and south, and is capped by 250 feet of basalt. Tunnel 1100 feet long being driven in Calaveras slate and diabase bedrock to cut below upper Table Mountain channel. Four men employed. Punchbowl Gravel Mining Company, Paris, France, owner. E. C. Shafer, general manager.

Saratoga Placer Mine (drift). Situated 1½ miles south of Columbia, on the east slope of Table Mountain. Course of channel northwest and southeast, width is 300 feet, with a depth of gravel of three feet. The bedrock is slate. Channel capped by a basalt flow 200 feet thick. Workings consist of an incline shaft 200 feet deep and a drain tunnel 1000 feet long, which intersects shaft at the 200-foot level. Three men are employed. Saratoga Mining and Development Company, 875 Willow street, Oakland, owner. J. F. Dieu, superintendent.

Stanislaus Gravel (If I Can) Mine (drift). Situated 12 miles southwest of Jamestown, on the Stanislaus River, on Table Mountain channel. Two channels have been developed, the pre-andesite channel (lower) and the andesite channel (upper). Channel capped by basalt flow 135 feet thick. Course of channel is northeast and southwest, width of gravel is about 100 feet with a depth of 8 to 15 feet. The bedrock is greenstone, hard and highly creviced. The gravel is partly cemented and free, containing boulders of quartz and andesite. The gravel is worked through a bedrock tunnel 1500 feet long, and treated in a Price disintegrating mill, having a capacity of 130 tons per twenty-four hours. Eleven inches of water are used in crushing gravel. Black sands are saved on No. 4 Deister table. Electric power is furnished by the Sierra and San Francisco Power Company. From 12 to 40 men are employed. Stanislaus Gravel Mining Company, 1010 Merchants National Bank Building, San Francisco, owner. A. G. Kullberg, manager.

Springfield Placer Mine (drift). Situated on ridge southeast of the Stanislaus River, near Columbia. Seven distinct channels have been developed on this property—Big Buchanan, Ranch, Fox, Clark, Rancheria, Barry, and Slaughter House. The main channel, called the Buchanan, enters the property on northwest corner, passing through the property in a southeast direction for a distance of 1¼ miles and is over 800 feet wide. These channels have been developed by three incline shafts; on the east slope of Table Mountain an incline shaft has been sunk to a depth of 240 feet, further south a shaft 900 feet deep on 18° incline, and 1100 feet west a shaft cuts the channel at a depth of 240 feet. On ridge above the Stanislaus River a 6000-foot tunnel is being driven under these channels. The formations are granite, slate and limestone. By means of this tunnel the company expects to drain the heavy flow of water encountered in the shafts, which prevented working the rich gravel found there. Air furnished for driving tunnel by two 12″ x 12″ Sullivan compressors. The gravel is treated in a Krogh gravel mill, having a capacity of 240 tons per twenty-four hours. Electric power is furnished by Sierra and San Francisco Power Company. Thirty men are employed. Springfield Tunnel and Development Company, Springfield, via Columbia, Cal., owner. A. L. Horner, manager; P. Cadematori, superintendent.

LIMESTONE AND LIME.

Pacific Lime and Plaster Company. This plant is situated 1 mile south of Sonora, in a belt of crystalline limestone in Calaveras formation, in Sec. 1, T. 1 N., R. 14 E. The holdings of the company comprise 180 acres. The limestone is being quarried from two large open cuts. The broken material is trammed or hoisted to five kilns, where lime is burned with oil. The capacity of the kilns is 20 tons each per twenty-four hours. The product of this plant consists of lime, limestone grits for chicken feed, and ground limestone for glassworks and agricultural hydrate for soils. The output is 225 barrels of lime per twenty-four hours. Thirty-five men are employed. Pacific Lime and Plaster Company, 807 Monadnock Building, San Francisco, owner. W. O. Badgley, general manager.

Sierra Lime and Cement Works. Situated 1½ miles south of Sonora, on ridge northwest of Sullivan Creek. The plant consists of three kilns of 20 tons capacity each. Idle. California Lime and Hydrate Company, 831 Monadnock Building, San Francisco, owner. W. A. Brown, president.

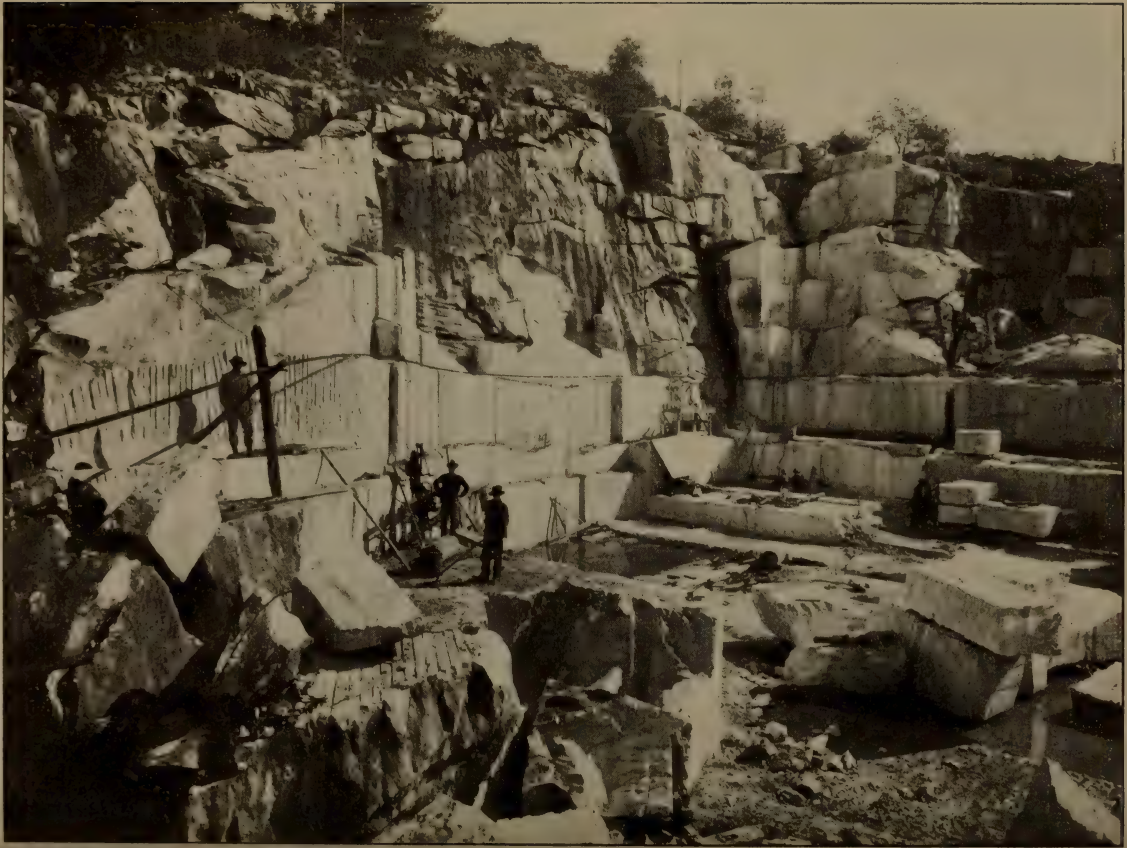
MARBLE.

Baxter Marble Quarry is 3 miles northwest of Columbia, to the south of the north fork of the Stanislaus River. Two quarries have been opened on this property, showing a good grade of marble. Idle. D. F. Baxter, of San Francisco, owner.

Columbia Marble Quarries. These quarries are situated 3 miles northwest of Columbia and 7 miles northwest of Sonora, on ridge southeast of the Stanislaus River. This company has been under steady operation since 1891, producing three grades of marble—medium, light and dark—and turning out a product that in beauty, durability and susceptibility to a brilliant polish is the equal of any in the United States. Besides the white, veined and black marble, it also produces a pretty blue marble, and a beautiful buff with red streaks, known as Portola. The marble is very hard, running as high as 11 cubic feet per ton, which makes it especially valuable as a durable stone. A body of marble 1 mile long with a depth of 800 feet and width of 200 feet has been developed, estimated at about 211,200,000 cubic feet.

The stone is quarried in blocks weighing 380 tons each, accomplished by cutting a vertical groove 10 feet deep around three sides, covering a space of 420 square feet. Then channeled holes 6 inches apart, 6 feet long, are drilled horizontally along the exposed vertical face on a line with the bottom of the groove. Then plugged and feathered. The block is subdivided into sections weighing 15 tons, which are hoisted from pit by means of derricks, and placed on cars and transported to the gangsaws.

Equipment: There are 8 Merriam gangsaws. A 25 h.p. motor drives three gangs, and 8 Francis sand pumps elevate sand to distributors for saws. A 360-cubic foot Ingersoll-Rand compressor furnishes air for



The Columbia Marble Quarry, Columbia, Tuolumne County, California.

Another view of the Columbia Marble Quarry, Columbia, Tuolumne County, California.

the drills. The company owns and generates its own electric power for lights and plant. Thirty-five men are employed. Columbia Marble Company, 268 Market street, San Francisco, owner. W. D. Bannister, manager.

Sonora Marble Quarry. In Sec. 25, T. 2 N., R. 14 E., 1 mile north of Sonora, on the Sonora and Columbia road. The marble is mainly a white crystalline dolomite; but some variegated varieties have also been developed. Waste product from quarry crushed for Terrazzo work. Equipment consists of one derrick (mast 50 feet high, boom 60 feet in length), 12″ x 12″ Ingersoll-Rand compressor, channelers, screws, rolls and crushers. The marble is being developed, and company plans to install a plant for dressing the stone. Employs 6 to 12 men. Sonora Marble Company, owner; Sullivan Brothers, 134 Haight street, San Francisco.

Warren Marble Quarry. In Sec. 35, T. 3 N., R. 14 E. The quarry and works are located about 3½ miles northwest of Columbia, on ridge south of the south fork of the Stanislaus River. The marble strip is 150 feet wide. The quarry face has been sufficiently opened to allow large quantities of any desired size of stone to be taken out. The pure white and variegated varieties have been developed. The marble is a compact, fine-grained, crystalline dolomite, free of iron and flint. Equipment consists of two 60-foot derricks, derrick hoist, channelers and compressor. Idle. Warren Marble Company, Merchants National Bank Building, San Francisco, owner.

PART II.

The Counties of

Colusa, Glenn, Lake, Marin Napa, Solano, Sonoma, Yolo

By WALTER W. BRADLEY, Field Assistant

INTRODUCTION.

The group of counties whose mineral resources are herewith presented is principally of that section of the State often referred to as "north of the Bay," lying adjacent to and immediately north of San Francisco Bay. A portion of the west side of the Sacramento Valley at its southern end is also included, as well as a portion bordering on the Pacific Ocean. This area includes the largest and most important mineral springs district of the State, and was also at one time a large producer of quicksilver, though to a lesser degree of recent years. Its yield of structural materials and building stone is also an important item, and growing.

The following report presents the results of four months of field work in the area described. But little geological detail was attempted, as it was desired to bring the economic data down to date without too much delay. We have listed as far as possible all mineral properties of whatever nature, their location, ownership, character of the deposit, method of working, equipment, and other information of interest.

We wish to acknowledge the uniform courtesy of the various operatives and owners in freely giving information as well as access to the numerous mineral properties visited.

COLUSA COUNTY.

Field Work in October, 1913.

Colusa County, like its neighbors, Glenn on the north and Yolo on the south, is one of the Sacramento Valley counties, with a portion of the Coast Range on its western edge. Its mineral resources are confined principally to the Coast Range section. Butte and Sutter counties bound it on the east, with Lake on the west. It has an area of 1100 square miles, with 65 square miles of the northeast corner lying on the east side of the Sacramento River. The upper branches of Stony Creek drain the northwest part of the county and Bear Creek the southwest, while several smaller streams traverse the eastern two thirds, to the Sacramento. Snow Mountain is at the northwest corner.

The eastern edge of the Coast Range is here composed of a series of sedimentary strata, principally sandstones, dipping at 45° to 75° to the east and under the valley alluvial deposits. Their strike is west of north. West of these are the metamorphic series. During the course of the field work I crossed the contact between the sedimentaries and the metamorphics at four separate points: about ½ of a mile west of Stonyford; 2½ miles west of Lodoga; 1½ miles east of Cooks Springs; and about ½ of a mile east of Wilbur Springs. Plotted on the map, these points are seen to be in a straight line, running about N. 20° W.

The mineral products of Colusa County, in the order of their production to date (see Table, page 4) are: Sandstone, mineral water, quicksilver, gold and silver, stone industry, salt, and brick. The total value is in excess of $2,600,000. In addition to these, occurrences of the following have been noted: Borax, coal, copper, chrome, gypsum, iron, limestone, mineral paint, natural gas, onyx marble, petroleum, and sulphur.

The actual output is in excess of that shown by the table, as the Manzanita mine is known to have been a gold producer as early as 1865. Also, high grade copper ore was shipped from the county in the early sixties. There are no available records of these values, nor for the quicksilver produced between 1877 and 1895.

ARAGONITE (see Onyx Marble).

BORAX.

Borax is an important constituent in some of the hot sulphur springs on Sulphur Creek, but it has never been extracted commercially from the waters.

Bibl.: R. III, p. 16; Bull. 24, pp. 69, 70.

TABLE OF MINERAL PRODUCTION.

Year	Gold and silver	Quicksilver		Sandstone		Mineral water		Stone industry	Miscellaneous and unapportioned
	Value	Flasks	Value	Cubic feet	Value	Gallons	Value	Value	
1875		700	$58,905						
1876		407	17,908						
1877		466	17,382						
1878									
1879									
1880	*$4,908								
1881	3,500								
1882	2,575								
1883	1,000								
1884	1,530								
1885	45,000								
1886	11,617								
1887	7,461								
1888	6,000								
1889	13,626								
1890	2,810								
1891									
1892									
1893	300								
1894				20,000	$7,500				
1895		1	40						40 tons, $400; salt.
1896		58	2,054			50,090	$12,530		
1897		43	1,510			31,500	1,620		8 tons, 160; salt.
1898						21,000	1,050		21 tons, 439; salt.
1899						5,000	1,120		20 tons, 300; salt.
1900		275	12,359			53,500	12,350		20 tons, 80; salt.
1901	1,800	235	10,575	88,981	80,082	92,200	20,220		18 tons, 270; salt. 270 M., 2,160; brick.
1902	850	605	26,100	99,395	87,456	142,305	79,698		18 tons, 393; salt.
1903		510	21,708	146,828	312,500	174,000	85,900		18 tons, 360; salt.
1904		†400	16,526	100,000	290,000	156,170	38,051	$1,250	18 tons, 180; salt. 300 M., 1,800: brick.
1905		326	12,321	118,954	276,908	160,000	80,000		18 tons, 225; salt.
1906				88,821	101,802	197,375	49,344		150 tons, 1,700; salt.
1907	742	17	648	86,954	78,259	254,075	51,233	3,500	16 tons, 240; salt.

1908	584	21	900	73,284	43,971	200,000	88,000	850	10 tons,	125; salt.
1909		11	545	47,070	24,634	150,000	75,000	620		
1910				112,947	56,505	150,000	75,000	16,500		
1911		5	230	101,029	50,027	136,300	68,150	16,702		1,596 unapp.
1912				51,137	15,804	165,330	39,061	15,300		
1913				34,927	15,550	132,720	32,931			
Totals	$104,303	4,080	$199,711	1,170,327	$1,440,998	2,271,565	$811,258	$54,722	$10,431	

*1880 to 1890, U. S. Mint Reports.

†Flasks of 75 pounds since 1904; previously 76½ pounds.

Totals.

Gold and silver	$104,303
Quicksilver	199,711
Sandstone	1,440,998
Mineral water	811,258
Stone industry	54,722
Miscellaneous and unapportioned	10,431
Total to end of 1913	$2,621,423

BRICK CLAY.

At one time bricks were made at Colusa, but not of recent years.

Bibl.: R. VIII, p. 159; Bull. 38, p. 242.

CHROME.

Chromite is reported in T. 17 N., R. 6 W., by J. T. Rathbun, of College City.

Bibl.: Bull. 38, p. 362.

COAL.

Some development work was at one time done on several small lignite veins near Sulphur Creek, but nothing of consequence was found.

Bibl.: R. VII, p. 190; VIII, p. 158; X, p. 158; XI, p. 188.

COPPER.

Copper ore has been found at several points in the northwestern part of the county near Stonyford (formerly Smithville), and various claims have been located at different times. None of these are now extant except the two groups noted below, and only assessment work is done on them. About 1861 there was something of a copper excitement in this section and a small tonnage of sorted ore was shipped to the Selby smelter. A smelter was built at the mouth of Hyphels Creek, but it proved a failure.

Bibl.: R. V, p. 98; VIII, p. 159; X, p. 158; Bull. 50, pp. 159, 160.

Lion Mine. Frank Fender, Stonyford, owner. This group of two claims (originally four) is in Sec. 17, T. 17 N., R. 6 W., and was first located about 1861. The ore carries native copper, cuprite and malachite, with some calcite; and the ore body is said to be 4 feet wide, strike northwest, dip 45° SW. The country rocks are serpentine and some basalt. There are two shafts (an incline and a vertical) and one adit. The depth of the old workings is not known. On the failure of their smelter built in the valley below, the original operators shipped hand-picked ore for a time to Selby's smelter. Only assessment work has been done of recent years.

Bibl.: R. IV, p. 125; V, p. 97; VI, Pt. I, p. 104; X, pp. 158, 261; Bull. 50, p. 160.

Ruby King Group (see under Mineral Paint.)

GOLD AND SILVER.

Clyde Mine. Geo. and Thomas Moyer, owners. It is in the SE. ¼ Sec. 12, T. 14 N., R. 6 W., 3 miles northwest of Sulphur Creek post office. For several years between 1880 and 1890, it contributed to the county's gold output; but only assessment work is maintained now. The gold, with small values in silver, occurs in a shale, there being no defined ledge.

Bibl.: R. XI, p. 183; XIII, p. 126.

Keely Claim. This claim, near the Clyde mine, and from which a small production at one time resulted, has been abandoned for several years.

Bibl.: R. XI, p. 184; XIII, p. 126.

Manzanita Mine. (See under Quicksilver.)

Ruby King Paint Mine. (See under Mineral Paint.)

Trout Creek Prospect. Barnett & Drew, locators. It is on the east side of Snow Mountain, northwest of Fouts Springs. A tunnel was driven in 1907, but no work has been done recently.

GYPSUM.

Gypsum has been noted at several points but not developed commercially.

Bibl.: Bull. 38, p. 283.

IODINE (see under Salt).

LIMESTONE.

Lambert Ranch. J. T. Rathbun, College City, in Sec. 20, T. 16 N., R. 5 W., north of Leesville. Lime has been burned from a deposit on this ranch but not recently.

Bibl.: Bull. 38, p. 66.

Manzanita Mine (see also under Quicksilver). Jones & Ryan, Sulphur Creek, owners. There is a belt of crystalline limestone on the western part of this property, which has been utilized locally. Idle.

Bibl.: Bull. 27, p. 45; Bull. 38, p. 66.

Wide Awake Mine (see also under Quicksilver). A. A. Gibson, Sulphur Creek, owner. There is a body of limestone composed entirely of fossil shells, on the Wide Awake quicksilver property. It has been utilized locally.

Bibl.: R. VIII, p. 188; Bull. 3, p. 6; U. S. G. S., Mon. XIII, p. 367.

MANGANESE.

Small amounts of manganese in jasper have been prospected on the eastern slope of St. John's Mountain west of Stonyford, but nothing of consequence developed.

Bibl.: U. S. G. S., Bull. 427, p. 164.

MINERAL PAINT.

Ruby King Mineral Paint Company (formerly the Ruby King Copper Mining and Townsite Improvement Company). Dr. A. M. McCullom, president; A. C. Kaufman, secretary; office, 1027 Eighth street, Sacramento. It is in Secs. 29 and 32, T. 17 N., R. 6 W., 4 miles south of west from Lodoga, elevation 1350 feet (bar.). The ground controlled includes forty acres under an agricultural patent and six unpatented mining claims. South of these the company also has a group of copper claims located in 1861 and from which some ore was shipped to the smelter. The present company relocated in 1898. The formation is an oxidized, ferro-magnesian igneous rock, so altered that the original rock could not be exactly identified. In this occur masses (see photo No. 102) of hematite and limonite (the latter in smaller quantity), both

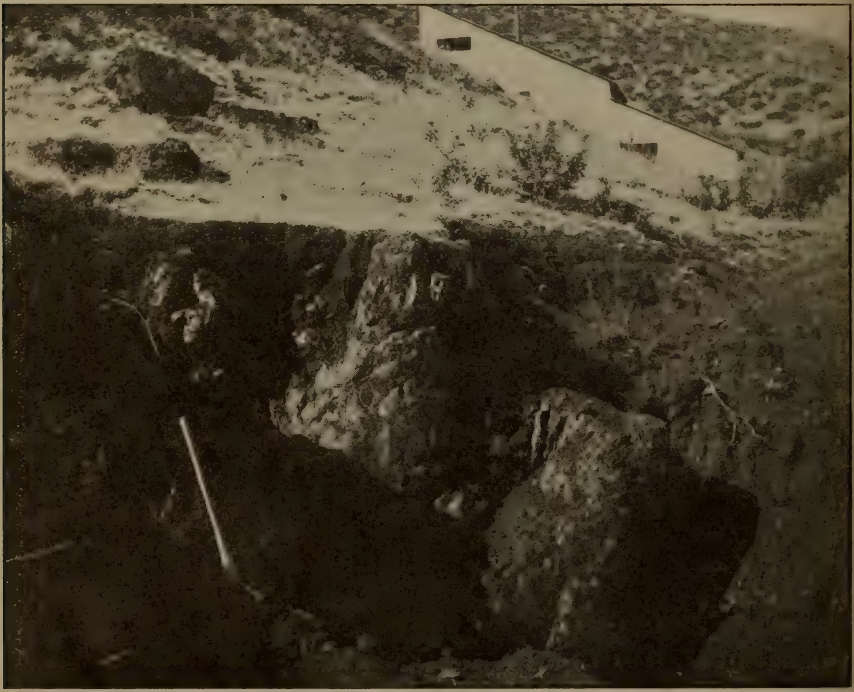


Photo No. 102. Outcrop of "paint rock" at Ruby King Mineral Paint Mine, Colusa County, California.

of which are more or less silicified. It outcrops irregularly and is irregularly colored. The material is said to carry up to $2 per ton in gold, and also small values in quicksilver. There are also occasional small green-colored patches due to associated epidote. It is mined by open cut.

In the mill there are two gasoline engines (25 h.p. and 4 h.p.); a 10″ x 12″ jaw crusher, and a Beer roller mill. The rock is crushed dry in the roller mill, through an 8-mesh screen in the front segment. The discharge drops in front of a blower. The fines are blown out along a "tube" (a wooden frame covered with cloth, about 3′ square by 20′ long), with cone hoppers set at intervals in the bottom. The coarser portions from the nearer cones are returned to the mill. At the time it was visited no commercial production had been made, as they were still experimenting with the equipment. The plant is intended to handle fifty tons per day. Practical tests made with experimental lots of this paint are stated to have been very satisfactory. In fact, the buildings at the mine which had been painted with it about a year before, still looked as fresh as if newly coated.

Bibl.: Bull. 50, p. 160; U. S. G. S. Min. Res. 1910, Pt. I, p. 697; 1911, Pt. I, p. 901; 1912, Pt. I, p. 939.

Woods & Harlan Prospect. F. C. Woods, Leesville, and H. H. Harlan, Williams, owners. It is in Sec. 35, T. 18 N., R. 7 W., 4½ miles west from Stonyford, on the south fork of Stony Creek; elevation 1300 feet (bar.). There are masses of both jasper and a highly siliceous yellow ochre outcropping along the creek. There are two principal outcrops of the yellow, showing 10 to 15 feet wide. It is undeveloped.

MINERAL WATER.

The mineral springs of Colusa County are all west of the line of contact between the sedimentary and the metamorphic series, thus bringing them within the area of the latter. Most of them are saline, some of them markedly so, particularly certain springs on Sulphur Creek.

Blank's Sulphur Spring. A. A. Gibson, Sulphur Creek, owner. This spring is now included in the Wide Awake quicksilver mining property. It is on the south side of Sulphur Creek, a short distance west of the post office. When the Wide Awake shaft (down 500 feet), which is a few hundred feet distant, was sunk it cut off this spring. As long as the shaft was kept open the spring was dry. Now that the shaft is filled with water to within 56 feet of the collar, the spring is again flowing, but its temperature is 104° F. instead of 108° F. as formerly. It is not utilized except locally.

Bibl.: R. XIII, p. 509; U. S. G. S. Bull. 32, p. 203; Water Sup. Pap. 338, p. 104; WINSLOW ANDERSON, "Mineral Springs and Health Resorts of California," p. 97.

Cooks Mineral Springs. Cooks Springs Mineral Water Company, owner; U. W. Brown, president; I. G. Zumwalt, secretary; A. A. Entrican, treasurer and superintendent; home office, Williams; H. S. Green, manager at the springs; post office address, Leesville. The springs are in Sec. 9, T. 16 N., R. 6 W., 10 miles northwest from Leesville and 32 miles from Williams. An automobile stage connects with the railroad at Williams during the summer season. The springs are in a canyon on a branch of Indian Creek, at an elevation of 1550 feet (barometric reading), and were first taken up by John Cooks about 1870. The present company was incorporated in 1899. The temperatures are: "Cooks" 63° F., "Iron" 55°, "Dead Shot" 61° to 65°. The first named is the principal spring and the one from which the water is bottled for sale. The "Dead Shot," in metamorphic sandstone, is a series of springs covering an area of about 20 feet square, on the side of and in the bed of the creek. It is ¾ of a mile up the canyon from the hotel and about 200 feet higher. Water is piped from it to the bathhouse. The other two are in serpentine. There are accommodations for 150 in the hotel and 175 in the thirty-five cottages.

Previous to 1900 water was bottled only for local sale in the county, amounting to a few cases monthly. At present the bottling works have a capacity of 10,000 bottles (5 per gallon) per day, requiring a crew of eleven men and a foreman. The plant is operated only from May to October. Steam power is used, burning wood, and with a 6 h.p. upright engine. The other equipment includes a mechanical bottle washer, crowning machine and a mechanical labeler. A block tin pipe over 300 feet in length conveys the water from the spring to the works which are seven feet lower in elevation. A pump forces the water through a cloth filter to take out any precipitated iron. It is not carbonated artificially but bottled with only its naturally contained gas. Two 10-mule teams were hauling the product to Williams.

Bibl.: R. VIII, p. 159; XIII, p. 509; U. S. G. S. Bull 32, p. 204; Water Sup. Pap. 338, p. 204; ANDERSON (op. cit.) p. 120.

At Fenders Ranch, about a mile west of Lodoga, the well which is used for domestic purposes yields a mild sulphuretted water from a depth of 65 feet.

Elgin Mine (see also under Quicksilver). New Elgin Quicksilver Mining Company; owner, W. S. Norman, Spokane, Wash. The Elgin is at the head of Sulphur Creek, about 3 miles northwest of the post office of the same name. From the ''lower'' tunnel, which is 500 feet above the bottom of the canyon, a stream of hot salino-sulphur water flows over 40,000 gallons per twenty-four hours. Its temperature is 138° F., and the odors of both sulphuretted hydrogen and ammonia are noticeable. It is strongly saline and is said to carry about 2000 grains of mineral matter per gallon. There is a considerable deposit of flour sulphur along the edges of the stream (see photo No. 105). Higher up near the top of the ridge there is another similar spring, temperature 152° F., which also has a strong flow. A peculiar feature of these hot springs is the presence in considerable numbers of a small fly around the edges of the streams and pools, even occasionally alighting on the surface of the hot water.

Photo No. 105. Hot salino-sulphur water flowing from tunnel of Elgin Quicksilver Mine at head of Sulphur Creek, Colusa County, California.

Though the property, as far as quicksilver mining is concerned, has been idle for some years, this water is utilized occasionally locally.

Some rather unusual curative effects ascribed to it (and also to the similar waters of both Jones and Wilbur springs) by reliable witnesses, it would seem to the writer, can only be explained by the possession of radioactivity. As suggested in the introduction to Mineral Water under Lake County, it is hoped that some day before long these and other similar waters in California will be properly tested for radioactivity.

Bibl.: SCIENCE, Vol. 23, 1894, pp. 120–121; U. S. G. S., Water Sup. Pap. 338, pp. 104–106.

Fouts Springs. C. H. Glenn, Willows, owner. These springs are in Sec. 5, T. 17 N., R. 7 W., 10 miles south of west from Stonyford, and about 35 miles from Willows, with which they are connected by automobile stage during the summer season. They are within the lines of the California National Forest, the ground (1350 acres) being held under an agricultural patent. They were located by John Fouts some time between 1850 and 1860. The springs are on Mill Creek and the South Fork of Stony Creek, in the edge of the hills surrounding a picturesque mountain valley at the foot of Snow Mountain. The elevation is 1800 feet (bar.) at the hotel. There are accommodations for 150 in the hotel and cottages. There are three principal springs, all in serpentine, and their temperatures are: ''Champagne'' (soda and iron) 67° F., ''Red Eye'' 76°, ''Bath Spring'' or ''Red Eye No. 2'' 76°. These latter two are salino-chalybeate, and are called ''Red Eye'' because of a bright red deposit of iron which has formed around the orifice. There is also a noticeable deposition of salt around these springs. They both have strong flows and show much excess carbonic acid gas.

Bottling the water for sale began in January, 1913, the plant being located at the Red Eye Spring about ½ of a mile north of the hotel. Water from this spring is bottled direct, not carbonated; while that from the Champagne Spring at the hotel is hauled in a tank wagon to the works and charged artificially. Steam power is used, burning wood. Equipment includes bottle washer, filling and crowning machines, automatic labeler, and a belt conveyor from labeler to packing table. Water from the Bath Spring is run in a small flume about 500 feet down the creek to the bathhouse near the bottling works. There is considerable jaspery quartz float on the north side of the creek (South Fork of Stony) opposite the works. This has been prospected for gold by a short tunnel at one point.

Bibl.: R. XIII, p. 509; U. S. G. S., Water Sup. Pap. 338, pp. 205–207.

Jones Hot Sulphur Springs. Tilden Jones and Mrs. J. A. Ryan, owners; post office, Sulphur Creek. The springs are in the canyon of Sulphur Creek, a mile above Wilbur Springs, 21 miles northeast of ower Lake and 26 miles southwest from Williams, with which it is onnected by automobile stage. The resort is open throughout the ear. Elevation 1475 feet (bar.).

There are several springs, both hot and cold, and two drilled wells, alled ''The Geyser'' and ''Nottingham Spring.'' The former (see hoto 104A) is intermittent, spouting every twenty to thirty minutes.

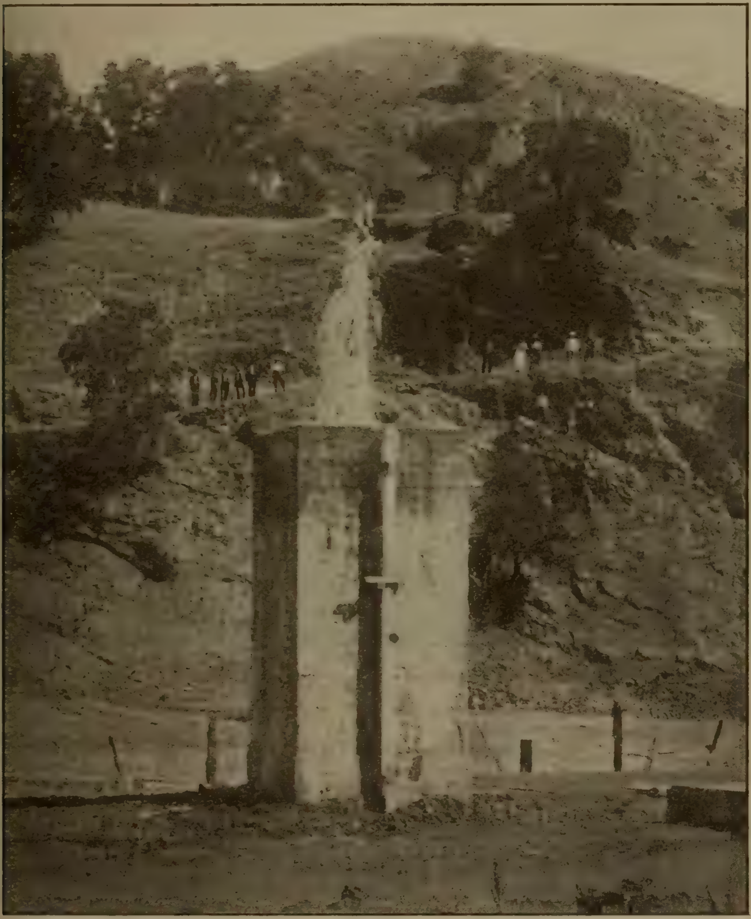


Photo No. 104A. "Geyser" at Jones' Hot Sulphur Springs, Colusa County, California. A drilled well—spouts every twenty to thirty minutes.

t is 196 feet deep and has a 3-inch casing in the upper part down hrough the softer surface material, the balance being in rock. A temerature of 156° F. was obtained. It is probably actually higher than hat, as it was difficult to hold the thermometer in the stream while pouting. The odor of both ammonia and sulphuretted hydrogen are oticeable, probably being in the form of ammonia sulphide with an xcess of H_2S. The vapor coming off just ahead of the water is inflammable. This may be due to the presence of finely divided sublimed sulphur, as there is an abundant deposit of flour sulphur about the vent. The water is caught by the concrete curb and piped to the bathhouse. The "Nottingham," temperature 177° F., flows a small pulsating stream, and has similar characteristics to the Geyser.

The other springs have the following temperatures: Mud Bath (black sulphur, in bed of creek) 108° F., Pink 97°, White 110°, Corn (white sulphur) 96°, Cold Black Sulphur 68°, Epsom Well 62°. The springs are associated with serpentine and with mineral veins. The Manzanita mining property (see under Quicksilver) is now owned in conjunction with the springs, which it adjoins on the north side of the canyon opposite the hotel. The Geyser was drilled in 1904, and the hotel built in 1906. No water is bottled from these springs, being used principally for bathing.

Photo No. 104. Wilbur Hot Springs, Colusa County, California.

Bibl.: U. S. G. S., Water Sup. Pap. 338, pp. 103, 104.

Salt Springs (see under Salt).

Wilbur Hot Sulphur Springs (previous to 1875 known as Simmons Springs). J. W. Cuthbert, Wilbur Springs, and F. K. Lippitt, Petaluma, owners, operating under name of Wilbur Springs Company. The springs are on Sulphur Creek, in Sec. 28, T. 14 N., R. 5 W., 25 miles southwest from Williams, with which they are connected by auto stage. The elevation is 1400 feet (bar.). These springs were utilized previous to 1860 by the Indians, but the present resort was built in 1908 and since enlarged. The ground, about 1700 acres, held under both agricultural and mining patents, includes also the Farris or Oriental quicksilver mine area. The springs, of which there are twelve principal ones in actual use, are found both in the creek bed and along the banks above. The formations include serpentine, also metamorphic sandstone and igneous rocks in process of serpentinization.

The temperatures of the main springs are as follows: Mud Baths, men's 128° F., women's 120° F.; Iron and Magnesia No. 26, 60°; No. 10 Hot Black Sulphur, 113°; No. 14 Rainbow, 80°; No. 20 Catarrh and Complexion, 116°; No. 22 Hot Sulphur, 131°; No. 24 Cold Magnesia, 60°; No. 34 Jackson, 72°; No. 28 Cold White Sulphur, 62°; No. 30 Cold Black Sulphur, 68°. The hot springs are strongly saline and sulphurous and also contain an appreciable amount of borax, so that it has a slightly soapy feel. Ammonia is also present. None of the water is bottled for sale. There are acommodations for 175 in the hotel and cottages, the resort being kept open throughout the year.

Bibl.: R. III, p. 16; VI, Pt. I, p. 59; VIII, p. 159; X, pp. 155-160; XII, p. 331; XIII, p. 509; U. S. G. S. Bull. 32, pp. 207, 209; Water Sup. Pap. 338, pp. 99–103, 105; GEOL. SURV. OF CAL., GEOL., Vol. I, p. 92; ANDERSON (op. cit.), pp. 244, 265.

In addition to the above there are a number of unutilized springs on the edge of Bear Creek, near its junction with Sulphur Creek (one called "Oil Spring"), and all along the latter from its mouth to the Elgin mine, but principally west of the contact between the sedimentary series and the metamorphics.

Deadshot Springs are on the Stovall & Wilcox ranch in Bear Valley, 5 miles southwest of Leesville.

On the Lovelady ranch, a mile east of the Ruby King mineral paint mine, there are two white sulphur springs in shale and sandstone. Also, about a half mile west of the same mine, there is a saline spring known locally as the "Deer Lick."

In the *McGilvray* sandstone quarry near Sites there is a small sulphur water spring at the lower edge of the quarry. Temperature 75° F.

Bibl.: U. S. G. S., Water Sup. Pap. 338, pp. 194, 195.

NATURAL GAS.

Natural gas in small quantities has been obtained along the western edge of the Sacramento Valley in Colusa County and in the foothills west of Arbuckle and Williams. On the Stovall ranch about 8 miles west of Williams, in 1885, gas was obtained in a well at 150 feet depth.

The water accompanying it was saline. Nearer the foothills and just below Mountain House (Venado post office) a 6-inch well drilled about 1865 yielded brine and an inflammable gas. Natural gas from a vent at the Elgin quicksilver mine at Sulphur Creek was utilized at one time by the company operating the mine. It also occurs at Wilbur Springs.

Bibl.: R. X., p. 156; Bull. 3, pp. 5-7; Bull. 19, pp. 159-161.

ONYX MARBLE.

There is a small deposit of beautifully banded, dark brown "onyx marble" or aragonite near Sulphur Creek. Specimens from this occurrence may be seen in the museum of the State Mining Bureau, and also in the National Museum in Washington, D. C.

Bibl.: R. VIII, p. 159; X, p. 156; Bull. 37, p. 111; Bull. 38, p. 369; U. S. G. S. Water Sup. Pap. 338, p. 106.

PETROLEUM.

There are some small oil seepages along the foothills west of Williams and also near the junction of Sulphur Creek with Bear Creek. From 1900 to 1910 drilling operations were prosecuted intermittently by several companies but nothing of consequence developed. The most prominent of these seepages is in Sec. 21, T. 14 N., R. 5 W., on land owned by A. A. Gibson, of Sulphur Creek. It is locally known as the "Gibson Gusher" and was made the basis for the operations of the Gibson Oil Company.

The Williams Oil Company operated at intervals from 1905 to 1910, drilling five wells at and near Mountain House (Venado post office). Their first well was sunk to 2560 feet. In their second well it is stated that at 55 feet a small seepage was struck, and at 690 feet three feet of sand with oil, also gas, which latter was used at the boiler. At that point the tools were lost. The third well went to nearly 2000 feet. The fifth well was stopped at about 1500 feet. This derrick is still standing and the well yields saline water and an inflammable gas. Neither are utilized. The following companies also operated in the district: Herron Oil Company, Corwin Oil Company, Gorrill & Smith Oil Company, Bear Valley Oil and Development Company, Chehalis Oil and Mining Company.

Bibl.: R. IV, pp. 295, 296; X, p. 164; XIII, p. 570; Bull. 3, p. 6; Bull. 19, pp. 159–161, 205; Bull. 69, p. 441; U. S. G. S., Water Sup. Pap. 338, p. 194.

QUICKSILVER.

Abbott Mine (see under Lake County).

Buckeye Mine (see Wide Awake Consolidated).

Central Mine (part of Manzanita).

Elgin Mine. New Elgin Quicksilver Mining Company, W. S. Norman, Spokane, Wash., owner. This mine is at the head of Sulphur Creek, in Sec. 13, T. 14 N., R. 6 W., about 3 miles northwest from Sulphur Creek post office. The last operations on this mine resulting in a production of quicksilver, were in 1908 and 1909, since which time it has been idle as it was for some years previous. One important difficulty in working this mine has been the hot sulphur water present (see under Mineral Water). This could probably be obviated by driving a drainage tunnel from the creek level, as the present ''lower'' tunnel is 500 feet above the retorts. The ledge matter is a black to white opaline rock (the black resembling obsidian) with cinnabar and an abundance of native sulphur crystals. In fact, so highly impregnated are the rocks here with sulphur (resembling the famous Sulphur Bank mine in Lake County) that in the early history of the property attempts were made to produce sulphur commercially by distillation. The mine is equipped with a retort furnace, and when last operated used a Griffin mill and Colorado bumping tables for concentrating the cinnabar.

Bibl.: R. VI, Pt. I, p. 136; XI, p. 182; XII, p. 359; XIII, p. 594; Bull. 27, p. 43; U. S. G. S. Min. Res. 1907, Pt. I, p. 679; 1908, Pt. I, p. 685; 1909, Pt. I, p. 552; Min. Res. W. of Rocky Mts., 1875, p. 14; 1876, p. 20.

Empire Group. Empire Consolidated Quicksilver Mining Company, Jas. H. Boyer et al., 1106 Merchants National Bank Building, San Francisco, owners. This property, in Sec. 28, T. 14 N., R. 5 W., near Sulphur Creek, is owned and was at one time operated in conjunction with the Abbott mine, which is principally on the Lake County side of the boundary line. It has been idle several years.

Bibl.: R. XI, p. 186; XIII, p. 594; Bull. 27, p. 43.

Farris or Oriental (see Wilbur Springs under Mineral Water).

Manzanita Mine. Tilden Jones, Sulphur Creek, and Mrs. J. A. Ryan, owners. This mine, now owned as a part of the Jones Hot Springs property, is on Sulphur Creek, in Sec. 29, T. 14 N., R. 5 W., 26 miles southwest from Williams. By reason of the Manzanita's ore carrying an important percentage of gold as well as cinnabar, in its earlier history the mine was worked for its gold content. While gold has been found at other places associated with mercury in small quantities (usually little more than a trace) the Manzanita mine is the one notable quicksilver mine of the world where there has been a sufficient percentage of gold to work the ore at times for that metal alone. Bituminous matter and native sulphur are also found here.

The first recorded mention of this gold occurrence was 1865 (Geological Survey of California, Geology, Vol. I, p. 92), and the deposit was worked principally for gold up to 1891. The major portion of Colusa County's gold output to date (see Table, page 4) came from the Manzanita. The total quicksilver production of the mine approximates 2000 flasks, the most of which was obtained by means of concentration during the eight years up to 1912. The ore was broken in a No. 1 Gates breaker to pass a 1-inch screen, then through a 5-foot Huntington mill with 20-mesh screen. Six Gilpin County, Colorado, bumping tables were used (since moved to the Ætna mine, Napa County), the tailings from which passed to cone separators. The underflow from the cones was passed to another concentrator. G. V. Northey, owner and operator during this period, states (Engineering and Mining Journal, Vol. 96, p. 783) that the mill treated from two to five tons per hour, the concentrates averaging 35% to 40% quicksilver (often as high as 68%), ''while the tailings for several months' milling averaged from 5 to 10 cents per ton.''

The dried concentrates, mixed with 10% to 25% lime, were retorted. Power required for the plant was 25 h.p., derived from a distillate engine. The concentrators were driven by a separate engine. The cost of milling is stated (loc. cit.) to have been 60 cents per ton of ore treated. ''Under some favorable conditions the cost of milling was reduced as low as 25 cents per ton. This low cost applied to ore that occurred in the form of sand, the common name in the camp being 'brown sugar.' The average value of the ore was about $5 per ton, or about 0.5% quicksilver.''

Bibl.: R. V., p. 96; VI, Pt. I, p. 33; VIII, pp. 157, 159; X, pp. 159, 161; XI, p. 184; XII, pp. 100, 359; XIII, pp. 126, 594; Bull. 27, pp. 44, 198, 202; GEOL. SURV. OF CAL., Geol., Vol. I, p. 92; U. S. G. S. Mon. XIII, p. 367; Min. Res. 1892, p. 147; 1902, p. 252; 1907, Pt. I, p. 679; 1908, Pt. I, p. 685; 1909, Pt. I, p. 552; 1911, Pt. I, p. 901; Eng. & Min. Jour., Vol. 96, p. 783.

Oriental (see Farris).

Rathbun Prospect (abandoned).

Bibl.: R. XI, p. 181; XII, p. 359; XIII, p. 594.

Wide Awake Consolidated (Buckeye). This mine, originally known as the Buckeye, is owned by A. A. Gibson, Sulphur Creek. It is a short distance from the post office and south of the creek, in Sec. 29, T. 14 N., 5 W., 26 miles southwest from Williams. It is on the opposite (east) de of the ridge from the Abbott mine. The property has been idle nce 1901, and the shaft (500 feet deep) is now filled with water.

This mine first appeared in the producing list in 1875. After having en closed for a number of years, it was reopened in 1896 and yielded small output for a time. The ore, carrying cinnabar, was found at d near the contact between serpentine and shale, strike northwest, p southwest about 60°. It is stated that this contact has been traced r about a mile in the company's ground, though the croppings are ore prominent near the plant. It was worked by both tunnels and aft, the latter being sunk in the shale. The vein matter was found to five feet wide, mostly soft, with the shale hanging-wall well fined, while the values were slightly disseminated into the serpentine otwall. The reduction equipment includes a 24-ton Scott fine-ore rnace.

Bibl.: R. XI, p. 187; R. XIII, p. 594; Bull. 27, p. 45; Geol. Surv. of Cal., Geol. Vol. II, p. 124; Min. Res. W. of Rocky Mts., 1875, p. 14; 1876, p. 20; U. S. G. S. Mon. XIII, p. 368; Min. Res. 1908, Pt. I, p. 685.

SALT.

For a number of years salt was manufactured by solar evaporation brine from a series of springs on the Peterson ranch in Antelope lley, near Sites. The Antelope Crystal Salt Company was the oper or. No production has been reported for the past five years. An teresting occurrence was the presence of an appreciable percentage iodine in the brine of one of these springs.

Bibl.: R. X, p. 164; XI, p. 180; Bull. 24, pp. 107, 114; U. S. G. S., Water Sup. Pap. 338, p. 298.

SANDSTONE.

The well-known Colusa sandstone is obtained from a series of massive ds just east of Sites and extending 8 miles north and south with width of over ½ mile. Sites is the terminus of the Colusa and Lake ilroad, narrow gauge, which connects with the Southern Pacific main ne at Colusa Junction. There the stone has to be transshipped to the andard gauge cars. Principally for this reason, the stone is not essed at the quarries but at the yards in San Francisco.

These strata extend both north and south of this section for a total ngth of about 20 miles, but outside of the 8-mile portion near Sites ey are not so massive. Their general strike is N. 20° W., with a p of 40° to 45° E. There are two quarries which are operated mmercially, the Colusa and the McGilvray. They adjoin, the first named being the older, and to the north (see photo No. 92). Both properties have railroad facilities. The canyon of Stone Corral Creek cut through the series nearly east and west at about the center of the Colus company's ground. The individual strata vary in thickness up to 1 feet so far as opened up by quarrying operations.

The stone is very even-grained and is quite uniform in color, being blue-gray which darkens but slightly in weathering. It is exceptionall well adapted for general use as a building material. Among other test made on this stone the following by Thomas Price & Son, analytica chemists, is of interest (State Mining Bureau, Bull. 38, p. 124): ''Whe heated to a red heat and plunged into water, the stone neither splinter nor cracks. It resists, without fusion, the temperature of a full whit heat, not even the sharp edges of the stone being blunted. Plunged int water after being subjected to a full white heat, the stone assumes light brown color.'' Colusa sandstone has been employed so far principally in San Francisco and other central California cities. Some ha also been shipped to Hawaii.

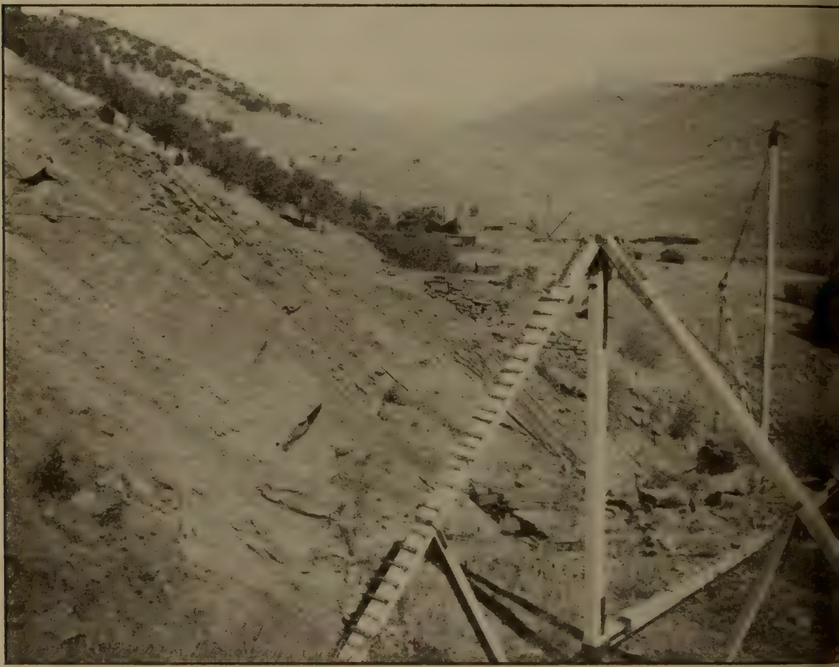


Photo No. 92. Sandstone beds in McGilvray quarry, Colusa County, California, lookin north. Bed in center 15 feet thick. Colusa sandstone quarry in middle distance.

Colusa Sandstone Company (O'Neil & Abbott; also Sites Sandston Company). F. E. Knowles, president; Abel Hosmer, secretary; hom office and yards, Tenth and Division streets, San Francisco. This quarr in the S. ½ of SE. ¼ of Sec. 20, T. 17 N., R. 4 W., ¾ mile east of Site as first opened up in 1891 by O'Neil & Abbott, and later worked by the ites Sandstone Company. Elevation 200 feet (bar.). The Ferry Building in San Francisco, 1896, was the first large building constructed of his stone. The most recent is the new fourth wing of the St. Francis Iotel, 1913 (see photo No. 175), the other three wings being from the IcGilvray quarry. In the quarry (see photo No. 98), a channeler and nachine drills are used, and the blocks are split off both by wedging and

hoto No. 175. St. Francis Hotel, San Francisco (December, 1913). Colusa sandstone.

y blasting. The equipment includes two derricks and a steam hoist. ormerly there was a well equipped plant of saws and other stone dressng machinery, but this work is now all done at the yard in San Franisco. The change was made to obviate the losses from spalling and reakage attendant on transshipping the stone at Colusa Junction.

This sandstone can be obtained in any desirable dimensions. There re four monolithic columns in the Bank Building at Santa Cruz from he Colusa Company, the pieces as shipped from the quarry being 22′ ″ long, by 4′ 10″ square at the bottom and 3′ 6″ square at the top. our others of the same size were shipped to the yard at the same time. n addition to those already mentioned above, stone for the following rominent buildings in San Francisco was furnished by the Colusa ompany: Butler (corner Geary and Stockton streets); Frenchmerican Bank; Monadnock (ten stories); Metropolis (now Merchants) ational Bank; Aronson (corner Third and Mission streets); and the

Gunst on the opposite corner; Kamm, above the Call Building; three Home Telephone buildings and the Spreckels band stand in Golden Gate Park. Also the Thomas Clunie building in Sacramento; Garden City Bank, San Jose; First National Bank, Monterey.

Bibl.: R. XI, p. 188; XII, p. 398; XIII, p. 635; Bull. 38, pp. 119-124.

McGilvray Stone Company. John D. McGilvray, president; John D. McGilvray, Jr., manager. Home office, 634 Townsend street, San Francisco. The McGilvray quarry is in Sec. 29, T. 17 N., R. 4 W., 1 mile southeast from Sites, and adjoins the Colusa property on the south. Elevation 165 feet (bar.). It was opened up by the present owners in 1900, having previously been a part of the Burgett ranch. There is a good face of stone exposed here, over 200 feet along the strike by about the same amount on the dip (see photos Nos. 92 and 93), though they have not the advantage of an open end exposure across the strata to work from, as there is where the canyon of Stone Corral Creek cuts through the Colusa Company's ground. Of large dimension stone two pieces 19′ x 5′ x 22″ have been shipped from this quarry.

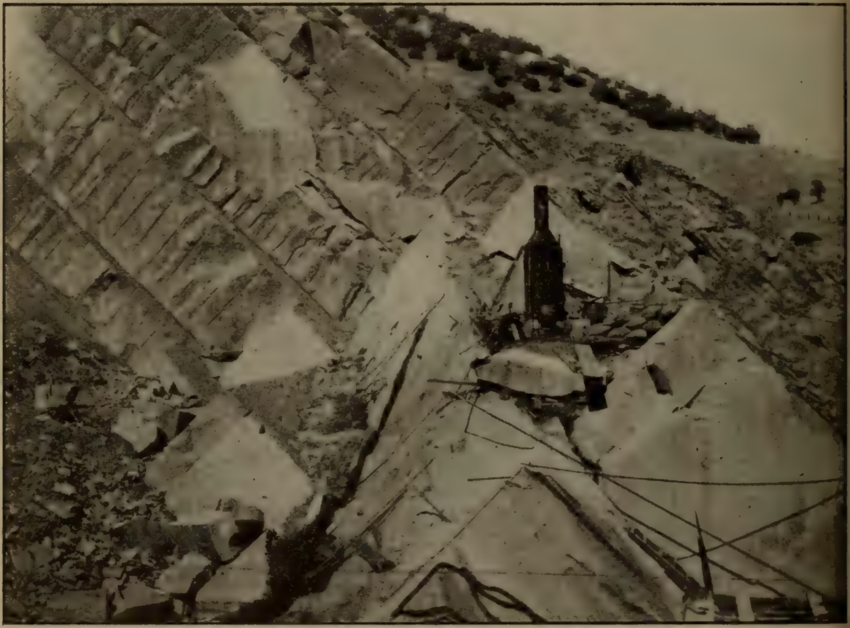


Photo No. 98. In quarry of Colusa Sandstone Company, Colusa County, California.

Among the more prominent buildings in San Francisco constructed of stone from this quarry, besides the St. Francis Hotel already noted, are the Flood Building; Kohl (originally Hayward); Humboldt Savings Bank (seventeen stories); Carroll & Tilton (above Call Building); Mutual Savings Bank; Sherith Israel Synagogue (corner California and Webster streets); Italian-American Bank, and the Shreve Building.

In blocking out the stone machine drills are used, and occasionally the channeler. On the thinner beds wedges are employed, while with the thick ones the drill holes are reamed V-shaped on two sides and sprung with powder. There are three derricks with steam hoists. Utah coal costs $10 to $11 per ton at Sites. Only a small amount of stone was shipped in 1913.

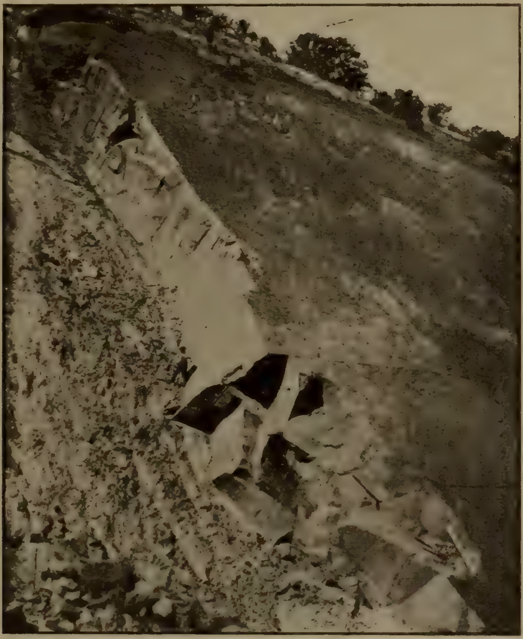


Photo No. 93. Fifteen-foot bed of sandstone, McGilvray quarry, Colusa County, California.

Bibl.: Bull. 38, pp. 119-125.

STONE INDUSTRY.

Both the *Colusa Sandstone Company* and the *McGilvray Stone Company,* near Sites (see under Sandstone), occasionally ship spoil from their sandstone quarries for use as macadam and rubble.

Bibl.: Bull. 38, p. 316.

The *City of Colusa* utilizes sand and gravel from the Sacramento River for street work. It pays 15 cents per cubic yard to the abutting property owners for hauling over their right of way. In an ordinary year the city uses 500 to 700 yards for street repair; but in 1913 considerable more was used on account of new pavement being put down, with a concrete base.

In the eastern part of T. 17 N., R. 3 W., near Maxwell and extending north into Glenn County, is a belt of old river gravel which is utilized occasionally for road work.

SULPHUR.

Sulphur in considerable quantities occurs at both the Elgin and Manzanita quicksilver mines at Sulphur Creek. Attempts were made at one time to produce it commercially, as was done at the Sulphur Bank mine in Lake County (*q. v.*), about 15 miles west of here, but without success.

Bibl.: R. VIII, p. 159; X, pp. 159, 160; XI, p. 187; Bull. 27, p. 43; Bull. 38, p. 354.

GLENN COUNTY.

Field Work in September, 1913.

Glenn County, formerly a part of Colusa, which is on its south, was formed March 11, 1891, and has an area of 1400 square miles. The Sacramento River forms the eastern boundary, separating it from Butte County. Tehama is on the north, with Mendocino and Lake on the west. The drainage is all tributary to the Sacramento, the principal streams being Stony Creek and Willow Creek. Being one of the valley counties, Glenn's resources are largely agricultural. Chrome, brick clay, gravel, and crushed rock are the only mineral substances from which commercial production has resulted so far. Besides these, occurrences have been noted of coal, copper, gold, granite, manganese, quicksilver, marble, sandstone, slate, and soapstone.

Table of Mineral Production.

Year	Amount	Value	Substance
1893 and previous	3,319 long tons	$49,700	Chrome.
1909	140,000 tons	49,003	Macadam.
1910	378,000 tons	34,020	Rubble.
1911	421,775 tons	51,430	Sand and gravel.
1912	543,675 tons	32,950	Sand and gravel.
1913	416,640 tons	27,776	Sand and gravel.
Total value		$244,876	

BRICK CLAY.

Bricks have been made from clay beds near Willows and Orland, but not of recent years.

Bibl.: Bull. 38, p. 243.

COAL.

Some years ago some work was done on several small coal veins on the west side of the valley, by the Glenn County Oil and Coal Company (now defunct), J. A. Apperson et al., of Willows; but nothing of consequence was developed.

COPPER.

Copper indications have been found at several points along the western part of the county and a number of claims located. With one exception these were all abandoned or idle in 1913. Prospecting was being done on a group of four claims located by J. A. Bedford, northwest from Elk Creek post office, in the Grindstone Creek section.

CHROME.

Black Diamond Mine (formerly Whitlock & Oakes). Guy M. Luce, Woodland, owner. It is in Sec. 25, T. 22 N., R. 7 W., 3 miles west of Millsaps. For a few years previous to 1894 this mine was an active producer of chrome ore, but it has not been worked of recent years. There are other deposits of chromite reported in the same range, but nothing has been done with them.

Bibl.: R. XII, p. 36; Bull. 38, p. 268.

GOLD.

Gold has been found near Millsaps and a little work done but nothing of consequence developed.

Bibl.: R. XII, p. 132.

GRANITE.

There is a dike of syenitic granite in sandstone on the Talbott Ranch, in Sec. 8, T. 18 N., R. 4 W., southwest of Willows. Not developed.

Bibl.: Bull. 38, p. 28.

MANGANESE.

North Star Claim. A. W. Sehorn, Willows, owner. In Secs. 14 and 23, T. 18 N., R. 7 W., about 6 miles northwest from Stonyford, Colusa County. It is stated that the manganese vein, 40 feet wide, was struck at 200 feet depth in driving a tunnel on a copper prospect. Values up to 65 per cent manganese, with $2.50 gold and 50 cents silver per ton are reported. Only assessment work is done. No production has been made to date on account of prohibitive transportation, the claim being reached only by trail.

MARBLE.

Alexander Brown, of Oakland, has a deposit of serpentine marble in the northwest corner of T. 18 N., R. 6 W.

H. A. Daniels, of Stonyford, has a deposit of white marble along the east side of Stony Creek in Sec. 21, T. 18 N., R. 6 W.

On the *J. M. Nye ranch* in the southwest corner of the county is said to be a body of onyx marble.

None of these deposits are as yet developed.

MINERAL WATER.

Alder Springs, 40 miles by road north of west from Willows, though not "mineral," have had a local reputation as a summer camping resort for some years.

There are salt springs in Salt Spring Valley, 4 miles north of Stonyford, and others a few miles west of Elk Creek post office. They are at present utilized only as salt licks for cattle.

Bibl.: U. S. G. S., Water Sup. Pap. 338, pp. 299, 359.

NATURAL GAS.

Natural gas has been reported on the Rideout ranch near Norman, in the western part of the county.

Bibl.: Bull. 3, p. 7.

ONYX MARBLE (see Marble).

PETROLEUM.

It is reported that options have been taken on land west of Germantown, with the intention of drilling for oil. Nothing has as yet been developed, nor does it seem likely from the geology that oil in commercial quantities will be found.

QUICKSILVER.

Cinnabar has been reported on the J. M. Nye ranch, southwest of Fruto, and on the Turner ranch west of Elk Creek post office. Not developed.

Bibl.: R. XII, p. 360.

SLATE.

Slate of good roofing quality occurs in the northwestern part of the county, but it is as yet undeveloped.

Bibl.: Bull. 38, p. 152.

SOAPSTONE.

Soapstone occurs in T. 18 N., R. 6 W., but it is not utilized.

Bibl.: Bull. 38, p. 351.

STONE INDUSTRY.

The only mineral product on the active list in Glenn County for the past three years is gravel. Besides the beds of the present creeks, there is an extensive, old gravel deposit running in an irregular line from Wyo southerly through the county, passing to the east of Willows. It extends to near Maxwell in Colusa County. As distinguished from the fresher gravels in the creek beds, this material has more or less clay mixed with it. The clay acts as a binder, and improves the value of the gravel for road material. However, the same feature makes washing necessary when it is used for concrete work.

Besides those noted below there are several small, privately owned pits, which sell gravel at 40 to 75 cents per yard at the pit.

County Pit (known locally as Forney Glen Pit). The county owns 40 acres in Sec. 24, T. 19 N., R. 3 W., 4 miles southeast of Willows, from which gravel is taken for use on the county roads in that vicinity. It also has a pit in Sec. 17, T. 20 N., R. 3 W. The gravel is loaded by Fresno scrapers and hand shoveling. During the past five years Glenn County has been using $20,000 value of gravel from various parts of the county on road repairs. Under a highway bond issue an additional $40,000 per year was spent for gravel for new construction in 1912 and 1913. In September, 1913, a reinforced concrete bridge, 1300 feet long, was being built (contract price $120,000) across Stony Creek at Wyo. California cement was employed and gravel from the creek bed utilized (photo No. 90.)

Photo No. 87. Southern Pacific Company's "Ballast Loader" at Wyo Gravel Pit, Glenn County, California.

Stony Creek Gravel Pit (Wyo Pit). Southern Pacific Railroad Company, Flood Building, San Francisco, owner. It is 1½ miles north of Orland. The company has 163 acres, extending from Wyo Junction down Stony Creek for over a mile. Operations began here sometime previous to 1882, since which time their holdings have been increased to the present area. The gravel is a clean, medium-sized material with no large boulders in it. A spur track connects the pit with the main line. A Bucyrus drag-line excavator (oil-burning) is used (see photo

No. 87); and at the time visited they were hauling out 30 to 40 carloads per day, carrying 30 to 35 cubic yards per car. Five men in the pit and a train crew of five were employed.

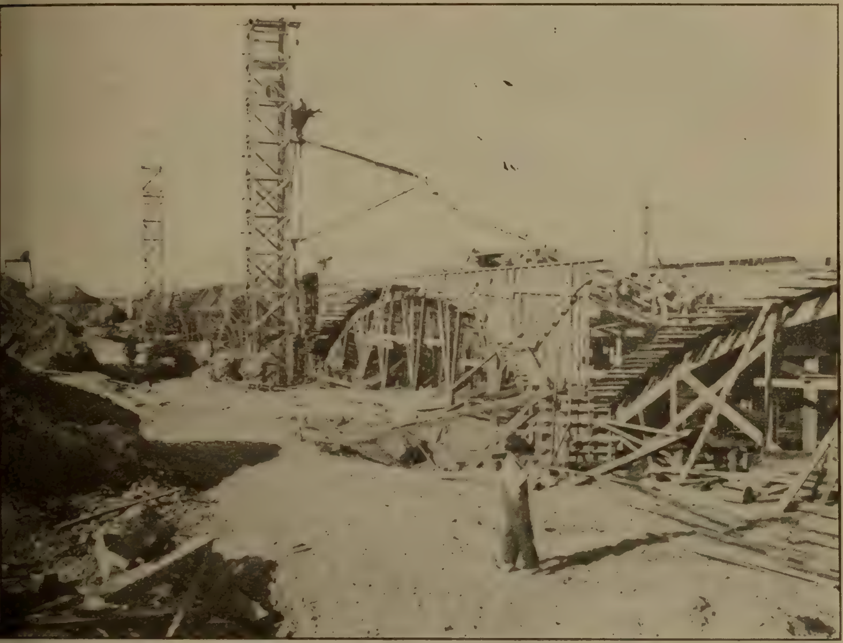


Photo No. 90. Side view of concrete bridge under construction over Stony Creek, near Orland, Glenn County, California, using California cement and creek gravel.

At Grapit siding, 4½ miles south of Orland, the company has 40 acres where the gravel has been taken out to a depth of 16 feet. This gravel has some clay in it. It is now idle as they have worked it out to their ines.

Willows, City Pit. The city of Willows owns 2 acres in Sec. 11, T. 19 N., R. 3 W., 2 miles east of Willows, formerly a part of the Garnet Ranch. In 1912 the city used 71,400 cubic yards at a cost of $1.25 per yard, spread, on street construction. In 1913 something over 7000 cubic yards were used on repair work. This pit is on the line of the older deposit mentioned above.

Wyo Pit (see Stony Creek).

Sandstone which could be utilized commercially occurs in T. 18 N., R. 4 W.; T. 20 N., R. 6 W.; T. 20 N., R. 4 W.; and near Newville. There s also suitable stone reported on the J. M. Nye ranch southwest of Fruto. Not developed.

LAKE COUNTY.

Field Work in August, 1913.

Lake County owes its name to the presence of Clear Lake, which is one of the prominent geographical features of that section of the state. Mendocino and Glenn counties bound it on the north; Glenn, Colusa, and Yolo on the east; Napa on the south; Sonoma and Mendocino on the west. It has an area of 1328 square miles. Of the southern two thirds of the county the drainage is mainly into Clear Lake, except its outlet, Cache Creek, which flows southeastward into the Sacramento River. Putah Creek which also flows to the Sacramento, has its upper branches in the extreme southern part of Lake County. North of the Clear Lake system, the drainage forms the headwaters of the Eel River, which empties into the Pacific Ocean.

Though Lake County has a variety of mineral occurrences and many interesting geological features, but two branches have been exploited or developed to any considerable extent: quicksilver and mineral water. There was also at one time a production of borax and of sulphur, but slight in amount and of short duration.

For a number of years quicksilver was the premier mineral in production for the county, but at the present time it has dropped to an almost insignificant figure, taking second place to mineral water. The greatest activity in quicksilver mining took place between 1875 and 1882, reviving again from 1891 to 1903; though the Abbott was a producer as early as 1870, the Great Western from 1873, and Sulphur Bank in 1874. The Mirabel (formerly Bradford), another important producer, was opened in 1887, but has been abandoned since 1897.

In addition to the above, there are also occurrences of barytes, chromite, copper, kaolin, gold, silver, manganese, natural gas, mineral paint, limestone and ''onyx-marble,'' also some petroleum seepages; none of these, however, are at present utilized commercially.

The following table gives the recorded mineral production of Lake County. The actual production is known to be in excess of these figures, due mainly to: (1) The lack of segregated figures for mineral water previous to 1895. (2) Quicksilver production of some mines previous to 1894 being included with mines of other counties under ''various mines.'' The figures for mineral water represent only that bottled for sale, as it is impossible to even approximate the amount consumed by guests at the resorts. Large amounts also run into the streams, unutilized.

Table of Mineral Production.

Year	Quicksilver		Mineral water	
	Flasks	Value	Gallons	Value
873	880	$70,790	*	*
874	1,695	178,280	*	*
875	8,821	743,287	*	*
876	14,199	624,756	*	*
1877	18,100	675,130	*	*
1878	14,428	474,681	*	*
1879	15,582	309,303	*	*
1880	17,148	531,588	*	*
1881	17,393	518,833	*	*
1882	10,193	287,748	*	*
1883	6,481	186,329	*	*
1884	4,182	127,551	*	*
1885	4,765	146,524	*	*
1886	3,498	124,179	*	*
1887	4,307	182,509	*	*
1888	6,636	282,030	*	*
1889	4,713	212,085	*	*
1890	4,232	222,180	*	*
1891	4,975	225,119	*	*
1892	11,140	453,509	*	*
1893	9,731	357,614	*	*
1894	12,471	382,954	*	*
1895	12,856	465,074	87,500	$42,000
1896	6,307	232,484	65,920	32,460
1897	3,585	134,546	511,950	76,585
1898	1,729	64,746	523,000	37,350
1899	2,954	128,179	166,020	75,924
1900	3,165	127,345	758,600	45,400
1901	4,395	211,324	201,706	120,360
1902	3,611	161,568	241,100	126,663
1903	2,595	106,397	381,040	187,621
1904	†2,854	109,719	659,000	221,000
1905	1,462	51,937	489,000	219,500
1906	1,066	38,909	365,000	160,000
1907	802	30,604	304,340	130,936
1908	1,300	54,951	246,545	118,300
1909	1,075	56,277	265,000	108,270
1910	1,048	47,422	212,546	95,005
1911	899	41,363	227,440	58,933
1912	209	8,786	202,000	114,500
1913	395	15,891	209,750	109,938
Totals	247,877	$9,404,501	6,117,457	$2,080,745

*Bartlett since 1888 and Witter since 1889 reported to U. S. Geological Survey, but no segregated figures available for Lake County, previous to 1895.

†Flasks of 75 pounds, beginning June 1, 1904. Previously 76½ pounds.

Borax	Sulphur	Pounds	Value
1864 to 1868 Borax Lake yielded 590 tons refined borax, worth $414,636; 1872 from Lake Hachinhama, 140 tons, worth $89,600; total 730 tons, worth $504,236.	1865	214,650	$8,030
	1866	675,963	21,970
	1867	487,603	13,420
	1868	503,481	10,080
	Totals	1,881,697	$53,500

Macadam	Tons	Value	Unapportioned		Value
1908	8,210	$10,000	1900-1909		$28,423

Totals.

Quicksilver	$9,404,501
Mineral water	2,080,745
Borax	504,236
Sulphur	53,500
Macadam	10,000
Unapportioned	28,423
Total to end of 1913	$12,081,405

BARYTES.

There is a specimen of barytes in the Museum of the Bureau, said to have come from near Glenbrook; but the deposit is not developed.

Bibl.: Bull. 38, p. 360.

BORAX.

Borax was at one time produced from Borax Lake, 8 miles west of north from Lower Lake and 2 miles south of the Sulphur Bank mine, having been first described by Dr. John A. Veatch in 1857 (see Report of State Mineralogist III, p. 15). In fact, the first commercial production of borax in the United States was made here in 1864, continuing to 1868, by the California Borax Company (op. cit., pp. 24, 78, 79). There was also some borax produced in 1872 from Little Borax Lake (Lake Hachinhama), 4 miles west of Borax Lake, on the opposite side of Clear Lake. The water of Borax Lake has a decidedly ''soapy'' feel from the large amount of borax in solution; and during the summer there is a considerable white deposit of the mineral around the shores of the lake (photo No. 21). It is now owned by W. S. Tevis of San Francisco, as a part of the Sulphur Bank property.

Bibl.: Rep. III, pp. 14–26, 78, 79; IV, p. 91; VI, Pt. I, p. 94; VIII, p. 326; X, pp. 237, 243, 269; XII, p. 34; XIII, p. 46; Bull. 24, pp. 51–52; Geol. Surv. of Cal., Geology, Vol. I, p. 98; U. S. G. S. Mon. XIII, pp. 244, 264–268; Min. Res. W. of Rocky Mtns. 1867, pp. 179-187; 1868, pp. 264-266.

CHROMITE.

There is a large undeveloped deposit of chromite in Sec. 32, T. 19 N., R. 9 W., 3 miles northeast of Hullville; also, it is reported found in considerable quantities along the divide between Lake and Mendocino counties, south and west from Highland Springs; also, in Jerusalem Valley, 8 miles east of Middletown.

Bibl.: Rep. VIII, p. 326; Bulletin 38, p. 362; Reg. of M., Lake County, p. 3.

CLAYS.

Kaolin, said to be of fine quality and in large quantities, is found in the Mt. Sam quicksilver mine on the side of Mt. Konocti, southeast of Kelseyville, in T. 13 N., R. 8 W. The company estimates that this material can be handled at a profit, if they had a railroad to within at least 12 miles of the mine. It is stated that there is a line of these kaolin deposits running southeasterly from the Mt. Sam mine to Thurston Lake; and that after the earthquake of 1906, the creek ran milky white for several days.

There are specimens of clays in the State Mining Bureau Museum from Glenbrook, Kelseyville, Soda Bay, and Sulphur Bank, but none of these deposits have been utilized.

Bibl.: Bull. 38, p. 361; R. IX, p. 303.

COAL.

F. P. Wattenberger claimed to have coal, 3 miles west from Lakeport, and with others had incorporated the Lake County Coal and Developing Company. The property was visited by the field assistant, and the material found to be only laminations of carbonaceus shale in a hard blue sandstone. Samples from the dump and from drillings from a well-boring rig with which the ground was being prospected, were sent to the laboratory for analysis. The field diagnosis was confirmed, with the addition that a trace of lignite was found in one specimen. The drillings showed the same character of material as that found on the dump from the shaft. The shaft was filled with water, so could not be entered.

Photo No. 21. Borax Lake from south side.

COPPER.

Christianson Ranch. Copper float has been found on the ranch of Peter Christianson in T. 13 N., R. 7 W., 4 miles northwest from Lower Lake. Some prospecting development work was done in 1879, but no vein found in place. Nothing has been done since.

Copper Prince Mine. H. C. Betts, of Middletown, owner. There are two parallel claims, the Buckeye and the Copper Prince, in Sec. 19, T. 11 N., R. 7 W., 4 miles northwest of Middletown, and above Harbin Springs, at an elevation of about 2000 feet. Only assessment work has been done, annually, so far; being developed mainly by 3 adits, one running in on the vein for 100 feet and reaching a depth of 200 feet below the outcrop. There is also a crosscut of 50 feet from this drift. The ore carries both azurite, malachite and some sulphide, and occurs in limestone. The owner reports having obtained assays up to 25 per cent copper and $6 per ton in gold, but that the formation so far as developed is too much broken up. The lower tunnel is beginning to look more favorable.

Poe Claim. Nothing has been done since 1900 on this prospect, 7 miles west of north from Lakeport.

There are *copper indications* and float reported near Hullville in the northern part of the county, but as yet no locations have been made nor any development work done.

Paul Stuparich has the continuation of the Copper Prince ledge on patented land above Harbin Springs, but no development work has been done.

The Langtry Ranch, 7 miles south of Middletown, Frank Smyth, lessee, is also said to have copper indications.

Bibl.: R. IV, p. 124; Bull. 50, pp. 162-163; Reg. of M. Lake Co., p. 3.

GOLD AND SILVER.

Albert N. Group. Two claims, partly on agricultural patented land of same owner, Albert Nelson, were located in 1911, in Sec. 31, T. 16 N., R. 9 W. The country rock is slate, and the vein formation varies from 5 to 15 feet in width, striking northwest and dipping to the west at about 40°. Development work consists of a 22-foot shaft with 50 feet of drift, and a tunnel of 50 feet. The ore carries pyrite, and assays of $5 to $34 per ton in gold and silver are reported to have been obtained.

LIMESTONE.

There is limestone near the Abbott quicksilver mine, and at Burns Valley north of Lower Lake. At the latter, the Sulphur Bank Mine Company at one time had two kilns, but nothing has been done there for about twenty years past.

Bibl.: R. XII, p. 392; R. XIII, p. 629.

MINERAL PAINT.

Bartels Bros. In Sec. 3, T. 15 N., R. 7 W., 2 miles north of Hough Springs, Bartels Bros., owners of the springs, have located two claims on a deposit of mineral paint. The deposit forms a low spur off one of the higher mountain ridges, and is said to be exposed for a width of 100 feet and 1500 feet in length. There are two colors lying alongside of each other, one being between a burnt umber and burnt sienna in shade, and the other a slightly dark, yellow ochre. The material is pulverulent, requiring little or no grinding, only screening and bolting, to prepare it for use as paint. Only assessment work has been done to date. Pits have been dug in the deposit to a depth of 10 feet, still showing the same character of material as appears at the surface. Samples have been shipped for tests and small amounts have been used for painting around Hough Springs, with favorable results. The deposit is reached by trail from Hough Springs, which is on the main stage road 26 miles west from the railroad at Williams.

Arthur Copsey has a deposit of hematite in Jerusalem Valley, near Dollar Springs, in Sec. 8, T. 11 N., R. 5 W., northeast from Middletown. It is used locally for paint.

MINERAL WATER.

The most prominent item in the mineral industry in Lake County at the present time is her mineral springs. This county has a greater number and variety of mineral springs than any other equal area in the United States, and probably more than all of Europe. Within an area of 1328 square miles (of which about $\frac{1}{15}$ is covered by Clear Lake) it has more than 20 groups of springs which are in active exploitation, including between 100 and 200 individual flows. In addition to those, there are innumerable springs of mineral water, both on private lands and on the public domain, which are not utilized nor exploited in any way. No section of the county is lacking in its quota. We predict that some day this part of California (the same characteristic extending to the adjacent portions of Mendocino, Sonoma, Napa, and Colusa counties) will become one of the greatest health resorts of the world.

Its one great drawback has been and still is: lack of transportation facilities; though automobile stage lines have improved it measurably of recent years. Lake County has not a single mile of railroad within its limits. Given rapid transit facilities, and there will come improved accommodations of hotels, etc., as the demand increases. The principal railroad entrances, now, are: Calistoga on the south; Pieta and Ukiah on the west; and Williams on the east. There are cures here for practically every ill of mankind which is curable by such treatment. There are two main classes of springs: the cold, as Adams, Bartlett and Witter; and the hot, like Seigler and Harbin.

As will be noted by an examination of the analyses, the characteristic constituents of the various springs cover a wide range, even showing marked differences in some closely adjacent waters. Some are suitable only for bathing; some, purely medicinal; while others are excellent table waters; and in each class may be found some the equal of any of the world-famed varieties of Europe; but, the properties, most of them, lack suitable accommodations and traveling facilities. They are not sufficiently advertised, and with two notable exceptions (in Lake County) they are without resident physicians. Practically all of the mineral springs of Lake County are delightful outing places as well as health resorts, and excellent hunting and fishing are to be had in their vicinities.

In 1890 Dr. Winslow Anderson in his valuable book "Mineral Springs and Health Resorts of California," called attention to the lack of system in the use and treatments at American resorts as compared to the European, saying that the European system "is the only thing our California mineral springs need to make them as successful in this treatment of the many chronic diseases as the späs of Europe are." And the same statement still applies to the majority of California resorts, today.

As to medicinal values, a short extract from Bulletin 91, pages 12-16, Bureau of Chemistry, U. S. Dept. of Agriculture, on the "Mineral Waters of the United States," will give a summary of the various classes and their particular values:

> The physiological action and therapeutic applications of the various classes of mineral waters here given do not represent the results of experiments carried on in the bureau of chemistry, but are gathered from works which are considered authoritative on the subject.
>
> *Carbonated or bicarbonated alkaline waters.* This is one of the most important groups of mineral waters. They are of value in catarrhal conditions of the mucous membranes, rheumatism, gout, diabetes, etc.
>
> *Sodic carbonated and bicarbonated alkaline waters.* * * * They have been used with excellent results in treating acid dyspepsia, rheumatism, gout and diabetes. Such waters are also of value in breaking up and eliminating uric acid deposits. * * *
>
> *Potassic carbonated and bicarbonated alkaline waters* have very much the same action as the sodic carbonated, except that they are perhaps better for increasing the solubility and elimination of uric acid. * * *
>
> *Lithic carbonated and bicarbonated alkaline waters.* While lithium seldom or never occurs in waters in large enough quantities to be a predominating basic constituent, still it does often appear in sufficient quantities to have a decided therapeutic action. * * * Waters of this class find their greatest application in the treatment of rheumatism, rheumatic tendencies and gout. In cases of gravel and calculi they are also valuable disintegrating agents.
>
> *Magnesic carbonated and bicarbonated alkaline waters.* Such waters as these act as mild laxatives. * * * and are much used in catarrhal conditions of the mucous membrane of the urinary organs.
>
> *Calcic carbonated and bicarbonated alkaline waters.* * * * This class of waters is quite different in its effect from the carbonated waters previously mentioned. While the foregoing waters are evacuant and promote secretions, this class of waters constipates and decreases the secretions. * * *

Ferruginous bicarbonated alkaline waters. * * * Such waters give excellent results when used as a tonic. They find their principal application in anæmia and in general debility brought about by sexual diseases.

Borated alkaline waters. * * * There are comparatively few springs of this description which have been used to any extent. Their therapeutic application, therefore, is somewhat obscure. It may be said, in general, that such waters act as anti acids. * * *

Muriated alkaline-saline waters. * * * These waters are especially valuable in the treatment of catarrhal conditions of the mucous membrane of the stomach, intestines, and biliary passages, and urinary tract. * * * The stronger ones are often used as a gargle.

Sulphated alkaline-saline waters. These waters, like the preceding class, are valuable in the treatment of catarrhal conditions of the mucous membrane. * * * In large quantities they act as purgatives * * * and are especially indicated in obesity.

Muriated saline waters. As a whole these waters stimulate the secretion of the stomach, increase digestion, favor a more complete absorption of foods, and act as diuretics.

Sodic muriated saline waters. Where these waters are very heavily charged with sodium chlorid they are often used for baths, to increase the action of the skin, and by absorption act as a tonic. * * *

Potassic muriated saline waters. * * * Its therapeutic action is very much like that of the sodium salt.

Lithic muriated saline waters. * * * Such waters as these would have the usual action of the muriated saline class, with an intensified diuretic effect due to the lithium.

Calcic muriated saline waters. These usually have sodium predominating. * * * In general debility they act as a tonic. * * * They are used in the treatment of scrofulous diseases and eczema.

Sulphated saline waters. As a class these waters are laxative or purgative, according to the quantity taken, and should generally only be used in moderate amounts. * * * They include: *Sodic and magnesic sulphated saline.* * * * Persons suffering from obesity, dropsy, derangement of the liver and Bright's disease are perhaps the most benefited by this class. *Potassic sulphated saline.* In so far as it is present, it has very much the same effect as the two salts mentioned preceding. *Calcic sulphated saline.* * * * This class of waters forms what is known as the permanently hard group. They have no well-known therapeutic action. *Ferruginous sulphated saline and aluminic sulphated saline.* Iron and aluminum usually occur together when either is present. * * * Since waters containing large quantities of iron and aluminum along with sulphuric acid ions are practically always acid, it is best to consider them under the sulphated acid group.

Nitrated saline waters. The authors have only found one water which belongs to this class. * * * The medicinal action of these waters has not been determined.

Acid waters. This group of waters is principally composed of the ferruginous-aluminic sulphated class, although there are a few acid springs which contain comparatively little iron and aluminum, but quite large amounts of calcium, sodium, and magnesium. These waters are used in relaxed conditions of the mucous membrane, * * *. When a water is desired for its tonic effect it is best to give it in the ferruginous carbonated form, since it is more easily absorbed and assimilated.

Iodic and bromic waters. * * * Waters of this class act as alteratives. * * * They also favor the elimination of mercury and other metallic poisons. The bromic waters also act as sedatives.

Arsenic waters. These waters act as an alterative, increase the appetite and digestion, and improve the whole nutrition of the body. * * * especially valuable in the treatment of anæmia and a number of skin diseases, also chronic malarial poisoning, neuralgia of anæmic origin, scrofulosis, etc.

Silicious waters. The medicinal value of these waters has not been thoroughly investigated, although one or two investigations have been made which seem to show that they would be of value in the treatment of cancer. It has been stated that silica taken internally has caused albumen and sugar to disappear from the urine.

Azotized and oxygenated waters. * * * Both nitrogen and oxygen are present in all waters that have come in contact with the air. * * * Neither of them as they occur in waters has any medicinal value.

Carbon dioxated water. These waters contain free carbon dioxid as distinguished from the carbonated or bicarbonated waters which contain carbon dioxid in combination. Usually the heavily carbon dioxated waters are also bicarbonated, but this is not necessarily true. Free carbon dioxide is present in practically all natural waters to some extent, but in some * * * it is present in very large quantities. Such waters are extremely palatable and large quantities can be drunk without causing a "full feeling." These waters tend to increase the flow of saliva and intestinal fluids. * * * Obstinate cases of nausea are often relieved by the use of this class of waters.

Carbureted waters. These waters sometimes occur in coal and natural-gas regions. They are not known to have any medicinal value, but are usually considered unfit for drinking purposes.

Sulphureted waters. These waters increase the action of the skin, intestines, and kidneys. They also possess a decided alterative effect. They have been used in the treatment of syphilis, chronic metallic poisoning, rheumatism and gout. They have given excellent results in many cases of skin diseases, hyperaemia of the liver, and in the catarrhal conditions of the pharynx, larynx and bronchi.

As between those enthusiasts who proclaim some particular mineral spring as a cure-all, and those scoffers who say ''it's the mountain air, exercise and change of diet,'' we have the following statement in ''Mineral Resources of the U. S.'' 1911, Part II, page 1192. In summing up a discussion of the therapeutic activities of mineral waters, Mr. R. B. Dole states: ''Some natural waters have therapeutic action that may be attributed to the inorganic substances in solution. Many other waters, however, owe what curative effect they may have to their character as fairly pure waters, free from organic contamination and from deleterious mineral constituents. The amount of inorganic matter that may be present in drinking waters without having appreciable physiologic effect is comparatively great.''

It is hoped that in the not too distant future, investigations may be made on the radioactivity of California's mineral springs—at least at the more important ones—by some official bureau, either federal or state, as has been done by the United States Geological Survey in the case of the Yellowstone Park waters. As shown by the results of the Survey's work (see Bulletin 395) there, radioactivity is not confined to thermal waters only, but some cold waters have this quality also.

Such localities as The Geysers in Sonoma County, Seigler's Springs and Sulphur Bank in Lake County, Calistoga in Napa County, and Sulphur Creek in Colusa County (not to mention some in other parts of the state) would be likely places for conducting such a series of investigations. On no other basis, it would seem, can we explain satisfactorily some of the remarkable cures authentically ascribed to certain mineral springs. Also, because it has been noted that certain waters show greater efficacy when used at the spring direct or shortly after being drawn. This peculiarity is a characteristic of radioactive waters, as the major portion of such activity is not a permanent quality.

> Bibl.: R. IV, p. 230; VI, Pt. I, pp. 61-64; VIII, pp. 327-329; X, pp. 230 *et seq.;* XII, pp. 334-337; XIII, p. 511; Reg. of Mines, Lake County; GEOL. SURV. OF CAL. Geology, Vol. I, p. 99; U. S. G. S. Mon. XIII; Bull. No. 32, pp. 202-214; Min. Res. U. S. 1888 to 1912; Water Sup. Pap. 338; "MINERAL SPRINGS AND HEALTH RESORTS OF CALIFORNIA," Winslow Anderson, M.D., 1890.

Adams Springs. These springs are in Sec. 26, T. 12 N., R. 8 W., 7 miles southwest from Lower Lake, and 30 miles north of Calistoga. They are in a beautifully wooded country, as is most of western Lake County, the principal timber being pine, "fir" (*Pseudotsuga taxifolia*), and oak. The springs are in the canyon at the head of Putah Creek, at an elevation of 2660 feet (barometric), and were first taken up by Charles Adams in 1872. The present owner, W. R. Prather, has had the property since about 1888, and states that he has increased his holdings until he at present owns 5000 acres in connection with the resort. There is a well equipped hotel and a number of cottages, with accommodations for a total of 350 guests. The main spring is at the hotel, and is an alkaline carbon-dioxated water very pleasant to drink. Its temperature is 50° F., and it has considerable free carbon-dioxide gas. There are also several other smaller springs. They have been bottling water from the main spring for the past twenty years, but only during the summer season.

> Bibl.: R. VI, Pt. I, p. 61; VIII, p. 327; XII, p. 334; XIII, p. 511; R. of M. Lake County, p. 5; U. S. G. S. Bull. No. 32, pp. 203 and 210; Water Sup. Pap. 338, p. 189; ANDERSON (op. cit.), p. 68.

Allen Springs. These springs were formerly operated as a resort, but are now owned by the Allen Springs Club, of Woodland, a private organization, for use only of members and their guests. P. T. Laugenour is president and John Reith, Jr., is secretary. The springs are in Sec. 8, T. 15 N., R. 7 W., in the canyon of Bartlett Creek 3 miles below Bartlett Springs, on the Williams-Bartlett stage road at an elevation of 1930 (bar.). They were first taken up by a Mr. Allen something over thirty years ago. There are numerous strong springs in the bed and side of the creek, 4 or 5 of them having cemented curbs. Gas can be seen bubbling up through the water in the creek for a space of 200 to 300 feet. The following are the temperatures of the principal flows: "White Sulphur," 57° F.; "Soda" 60°; "Soda and Iron'' (3 springs) 63°; ''Allen'' (at club house) 56°. The last named is the one from which water has been bottled for sale.

> Bibl.: R. VI, Pt. I, p. 62; VIII, p. 327; XII, p. 334; XIII, p. 511; R. of M., Lake County, p. 5; U. S. G. S. Bull. No. 32, p. 203; Water Sup. 338, p. 198; ANDERSON (op. cit.), pp. 76–78.

Anderson Springs. These springs which are in Sec. 25, T. 11 N., R. 8 W., have been in the possession of the Anderson family since their location in 1873, the present owner being Miss Barbara Anderson. They are picturesquely situated in the timbered section of southwestern Lake County, 6 miles northwest from Middletown and 24 miles north from the railroad at Calistoga, at an elevation of 1525 feet (bar.). There are eight springs in active use, besides several others. The ''Cold Sulphur'' (white), below the hotel, has a temperature of 63° F. The others are mostly above the hotel, and have the following temperatures: ''Iron,'' 103° F.; ''Sour,'' 65°; ''Bellmer,'' 65°; ''Magnesia'' or ''Father Joseph,'' 70°; ''Hot Sulphur and Iron,'' 145°; ''Iron and Magnesia,'' 103°; ''Steam Bath,'' 138°. Around the last two named, there is considerable sulphuretted hydrogen gas escaping. The hotel has accommodations for over 100 people.

Besides the detailed analysis shown in the ''Table of Analyses,'' the ''magnesia'' or ''Father Joseph'' spring carries Epsom and Glauber's salts, also traces of chromium. At the ''steam bath,'' a series of small rooms has been built against the bank, covering the fissures where the hot vapors escape from the rock. The steam enters through holes in the walls and floor. The temperature in these rooms is 138° F. If the thermometer could have been put into the rock fissure itself, a higher temperature would probably have been recorded. The ''hot sulphur and iron'' spring is about 15 feet from the steam bath; and there is a deposit of fine flour sulphur around the inside of the barrel enclosing the spring. The rocks and bank around these springs are encrusted with deposits of salts from the vapors, resembling the similar but larger deposits of such materials at The Geysers in Sonoma County which are but 6 miles in an air-line, northwest of Anderson Springs, on the other side of the range.

> Bibl.: R. VI, Pt. I, p. 62; VIII, p. 327; XII, p. 335; XIII, p. 511; R. of M., Lake County, p. 5; U. S. G. S. Bull. 32, p. 203; Water Sup. Pap. 338, pp. 89–91; ANDERSON (op. cit.), pp. 82–89.

Bartlett Springs. Bartlett Springs were discovered in 1869 by Green Bartlett, while on a camping trip. As he was suffering from rheumatism at the time, and found himself benefited by use of these waters, he took up the springs and established a resort there. Though the farthest from the railroad, Bartlett Springs is today the largest and best equipped in accommodations of any of the Lake County resorts.

It is in Sec. 2, T. 15 N., R. 8 W., near the head of Bartlett Creek, a branch of Cache Creek, at an elevation of 2375 (bar.) feet above sea-level. The present owner is the Bartlett Springs Company, office 634 Third street, San Francisco, C. E. McMahan, president, with G. A. Otto, manager, at the springs.

There are two main ''roads'' to Bartlett Springs: (1) by auto stage, 42 miles from Williams, Colusa County, on the east side; or (2) by auto stage from the railroad at Pieta in Mendocino County on the west, to Lakeport; thence by gasoline launch across Clear Lake to Bartlett Landing; finishing by auto stage, up over the mountain ridge (crossing at an elevation of 4040 feet) to the springs. Leaving San Francisco at 7.45 a. m. one reaches Bartlett's at 4.30 p. m. the same day, by either route. The second is by far the more picturesque, particularly on the return trip in the morning as the machine winds in and out around the many turns of the road. At each turn one gets a new view of Clear Lake and its beautiful mountain setting. From the summit to the level of the lake, a horizontal distance of about 3 miles, is a drop of 2700 feet in altitude.

There are three springs, the principal one having a good strong flow and a little excess gas. Its temperature is 56.5° F., and it is a delightful water to drink—clear and sparkling. It is walled in with a cement curbing and surrounded by a pavement of the same. The whole arrangement makes a unique and picturesque setting (see photo No. 8). For the bathhouse the water is artificially heated. The ''Soda-magnesia'' spring has a temperature of 59° F.; but the ''Aperient'' was dry at the time of our visit. It is said to be intermittent and sometimes ''roars'' with excess gas. Besides these there is a ''gas spring,'' higher up on the hill, which emits a considerable volume of moist carbonic acid gas, but no water.

There are several buildings and a large number of cottages, besides the main hotel, with accommodations for a total of over 500 people. Additions have been made, each of the last two years; yet, the manager reports having had to turn away 200 applicants during the month of July this year (1913). There is a resident physician at Bartlett's during the season, from May 15th to October. The postoffice is in the hotel, and there is a general merchandise store, drugstore, bakery and a butcher shop maintained by the company for the accommodation of cottagers and campers.

The bottling works are below the hotel, the spring being above, giving a good working hydrostatic pressure at the plant. In bottling Bartlett water, it is drawn from the bottom of the spring through a block tin pipe, to prevent the escape of the natural gas that the water contains, and through a Bergfeld filter. The bottles are filled through a tube that extends to the bottom of the bottle, and when filled are at once hermetically closed with crimped caps. Before packing each bottle is carefully examined and all defective ones emptied. It is adapted for exportation. It is free from organic matter and is charged only with its own natural gas. In addition to the water bottled at the spring, a small amount is shipped in barrels to the San Francisco office, and there bottled, carbonated—being labeled "sparkling."

The bottling works are equipped with a gasoline engine for power, a large mechanical bottle washer, labeling machine, belt conveyor (to carry bottles from labeler to packers), and other mechanical appliances.

Photo No. 8. "Bartlett" Spring, at Bartlett Springs, Lake County, California.

Fifteen men are employed and the plant has a capacity of 10,000 bottles per day of nine hours. The bottles are the usual mineral water size (5 per gallon) and are packed in cases of 50.

An ice plant is also installed there. The first two or three years of bottling, two 4-mule teams were required to haul the product to the railroad at Williams. Now, there are from eight to twelve, 8, 10, and 12-mule teams on the road during the five months from May to October.

No water is bottled during the winter and spring months, as the roads are in bad condition and there are no storage facilities at the springs.

Bibl.: R. VI, Part I, p. 92; VIII, p. 327; X, p. 253; XII, p. 335; XIII, p. 511; R. of M. Lake County, p. 5; U. S. G. S. Bull. No. 32, p. 203; Water Sup. Pap. 338, p. 201; ANDERSON (op. cit.), pp. 91–94.

Behr Soda Spring. It is in Sec. 10, T. 13 N., R. 8 W., on the edge of Clear Lake, 5 miles east of Kelseyville, and is owned by John Behr, of Upper Lake. It is not utilized commercially.

Bibl.: R. of M., Lake County, p. 5.

Blue Lakes. At Blue Lakes (Midlake, P. O.) in Sec. 6, T. 15 N., R. 10 W., 18 miles east of Ukiah, are two springs, a ''sulphur'' and an ''iron,'' the former of which is said to have a temperature of 60° F. The Blue Lakes Realty Company owns the property, with H. W. Kemp, Midlake, manager of the resort, which is located between the upper and lower lakes.

Bibl.: R. of M., Lake County, p. 5.

Bonanza Springs are in Sec. 30, T. 12 N., R. 7 W., between Seigler and Howard Springs, 5 miles southwest from Lower Lake, and 2 miles east of Adams Springs. They are on a comparatively flat ridge in a section of rolling hills, with abundant pine, ''fir,'' oak, alder and manzanita. The elevation is 2400 feet (bar.). These springs have been in use over twenty-two years, the present owners, C. N. E. Ehret and H. Penning having bought it in 1910. At one time there was a large hotel there, but it was destroyed by fire, and at present the springs are used only as a camping resort. No water is bottled for sale. The temperatures of the principal springs are: ''white sulphur'' 64° F.; ''iron and soda'' 59.5°; ''magnesia'' (a well) 66°; fresh water (well) 55°; ''borax'' and ''iron'' were dry at the time of our visit, as the result of a succession of three dry years.

Bibl.: R. VI, Part I, p. 92; VIII, p. 327; XII, p. 335; XIII, p. 511; R. of M., Lake County, p. 5; U. S. G. S. Bull. No. 32, p. 204; Water Sup. Pap. 338, p. 190; ANDERSON (op. cit.), p. 100.

Borax Springs. There are borax springs on the edge of Clear Lake, near both Borax Lake and Little Borax Lake (Hatchinhama) but they are not utilized except locally.

Bibl.: R. VI, Part I, p. 63; VIII, p. 327; X, p. 239; R. of M., Lake County, p. 5; GEOL. SURV. OF CAL. Geol Vol. I, p. 99; U. S. G. S. Mon. XIII, pp. 266–268; ANDERSON (op. cit.), pp. 101, 168, 176.

Bynum Spring is at the head of a small branch of Scott Creek, which is dry in summer. The surrounding hills are bare except for chamiso brush. It is 6 miles southwest from Lakeport, in Sec. 9, T. 13 N., R. 10 W., and is reached by a good wagon road, being 14 miles east of Hopland, its railroad shipping point. The spring is named for its locator, who found it about fifty years ago; but bottling began only about five years ago. There is no resort there. The present owner is Geo. W. Crippen, of Richmond. The elevation is 1800 feet. The spring flows about 10 gallons per hour, the temperature being 60° F. It is an excellent table and bar water. There is a little excess gas. The bottling is done by hand, and a hand-operated crowning machine used.

Bibl.: R. of M., Lake County, p. 5; U. S. G. S. Water Sup. Pap. 338, p. 182.

Carlsbad Springs. These springs in Sec. 1, T. 12 N., R. 9 W., 5 miles south of Kelseyville were utilized at one time, but are now abandoned. Mrs. E. McGovern of Kelseyville is the owner.

Bibl.: R. of M., Lake County, p. 5; U. S. G. S. Water Sup. Pap. 338, p. 187.

Castle Springs (Mills). These springs were formerly known under the name of Mills, also Noble's Springs. They are in Sec. 26, T. 11 N., R. 8 W., 7 miles northwest from Middletown, 1 mile above Anderson Springs, at an elevation of 2450 feet (bar.). They were located about thirty years ago, by W. Mills. The property has been in litigation, but is now owned by Mrs. Campbell-Van Luven, who states that it will be reopened next season (1914). A fine, cement-lined swimming pool 25 by 60 feet has been built recently. The "Big Hot" sulphur spring which is in a small canyon above the hotel flows about 40,000 gallons per twenty-four hours, and has a temperature of 163° F. at the spring. It is piped to the bath house and swimming tank. Other springs on the place are: "Sour" 65° F.; "black sulphur" 67°; "white sulphur" 66°; "Vangas" 66° (much H_2S escapes from bank around this spring); and a small hot spring, uncurbed, issuing from the bank near the large one has a temperature of 153° F. The hotel and cottages will accommodate 75.

Bibl.: R. VIII, p. 328; XII, p. 337; XIII, p. 511; U. S. G. S. Bull. No. 32, p. 206; Water Sup. Pap. 338, pp. 91–93; ANDERSON (op. cit.), p. 194.

Chambers Ranch. On the ranch of C. M. Chambers, in Sec. 24, T. 13 N., R. 10 W., 6 miles south of Lakeport, there are several springs, one of which has been analyzed. They are at present not utilized, except privately.

Complexion Springs are on the Williams-Bartlett stage road, near the eastern boundary of the county, in Sec. 10, T. 15 N., R. 6 W., but they are not utilized, except by occasional camping parties. As the name implies, they are claimed to have the property of improving one's complexion. The water has a milky appearance, similar to some "arsenic" springs. The principal constituents are sodium chloride and ammonia.

Bibl.: R. of M., Lake County, p. 5; U. S. G. S. Water Sup. Pap. 338, p. 297.

Copsey Springs (see *Spiers*).

Crabtree Springs, in Sec. 25, T. 17 N., R. 9 W., about 12 miles northwest from Bartlett Springs, are owned by S. T. Packwood of Upper Lake, who reports that he is planning to build a resort there.

Bibl.: R. of M., Lake County, p. 5; R. XI, p. 61; U. S. G. S. Water Sup. Pap. 338, p. 106.

Dennison (see *Hazel*).

Dollar Springs. These springs, formerly known locally as Warm Springs, are located on Black Mountain, in Sec. 8, T. 11 N., R. 5 W., 11 miles northeast from Middletown. They are said to have been used for many years by Indians. The present owner, B. Norman of Richmond, reports having sent out a trial shipment of bottled water the past summer.

Grizzly Medical Springs. These springs, at one time called "Richardson's" are owned by Samuel Richardson, and are near the eastern line of the county, 5 miles west of Sulphur Creek (Colusa County) post office in Sec. 3, T. 13 N., R. 6 W. Their elevation is 1365 feet (bar.). They were first used forty-two years ago, and the present owner has had them since 1908. He has been bottling water, in a small way, since 1909. Both the "Grizzly" and the "Bath" springs have a temperature of 70° F. Water from the latter is heated artificially for bathing. There are a few cottages and space for campers. There are several other springs not at present utilized. Probably one of these is the "Iodine" spring mentioned in some of the early reports (see Bibliography), as no iodine is indicated in the analyses of either of the springs above named.

Bibl.: R. IV, p. 230; VI, Pt. I, p. 63; X, p. 264; U. S. G. S. Bull. No. 32, p. 205; Water Sup. Pap. 338, p. 193; ANDERSON (op. cit.), p. 183.

Harbin Hot Springs. This is one of the well known groups of springs of Lake County; and is located 20 miles north of Calistoga, 3½ miles northwest of Middletown, at an elevation of 1625 feet (bar.). The springs were first used by white men about fifty years ago, and by the Indians previous to that time. The property is owned by Mrs. Margaret Matthews of Vallejo, and is under lease to Booth, Carr and Booth. There are accommodations for 300 people. No water has been bottled of recent years. There are steam baths and two swimming pools, the larger one being in the open air. One of the steam baths is a covered pool from the "hot sulphur" spring.

The following temperatures were taken at the point of outflow of the individual springs: "hot sulphur," 120.5° F. (stated to flow 1500 gallons per hour); "iron," 118° (60 gallons per hour); "magnesia," 66° (small flow); "cold white sulphur," 76° (new spring, small flow); "mud foot bath," 101° in water on top and 121° in mud and fine rocks below. There is also a fresh water spring which fills a 30,000 gallon tank in two days (used for fire purposes). The "arsenic" spring was caved in at the time of our visit.

> Bibl.: VIII, p. 327; X, p. 230; XII, p. 336; XIII, p. 511; R. of M., Lake Co., p. 6; U. S. G. S. Bull. No. 32, p. 205; Water Sup. Pap. 338, pp. 93–95; ANDERSON (op. cit.), pp. 164–168.

Hachinhama (see *Borax Springs*).

Hazel Springs were formerly known locally as Dennison Springs. They are in Sec. 26, T. 16 N., R. 9 W., 6 miles northeast of Upper Lake, and are owned by Amos Ogden. He reports preparations being made to develop and utilize the springs, also to bottle the water.

> Bibl.: U. S. G. S. Water Sup. Pap. 338, p. 202.

Highland Springs are 14 miles east of Pieta on the main stage road to Lakeport. The springs are in Sec. 31, T. 13 N., R. 9 W.; but there are 2300 acres in the property which is maintained in the nature of a hunting and fishing preserve in connection with the resort. Craig & Stephens, Inc., of Woodland, are the owners, with W. I. Allen, manager. There is a resident physician during the summer season. There are accommodations for 315 guests. No water is bottled for sale.

There are twelve principal springs in active use, and over twenty others. All have more or less excess carbonic acid gas bubbling from them—the "Magic" spring being especially vigorous. The temperatures are: "Neptune," 79° F.; "Iron," 73°; "Diana," 80°; "Seltzer," 61.5°; "Kidney," 80°; "Magic," 80°; two "Magnesia," 71.5° and 73° (20 inches apart); "Sulphur," 59.5°; "Dutch" or "Ems," 75°, and "Arsenic," 77°. The fissures from which these last two flow are but

18 inches apart in the edge of the creek bed, and are unique not only n situation but in appearance as well (see photo No. 4). The Dutch s crystal clear, while the Arsenic is milky. The springs at Highland re principally in serpentine. Gas is seen bubbling up through the vater in the creek at several points. At places in the serpentine were bserved rounded nodules of the original, unaltered sedimentaries (sandstone and shale), as noted by Becker in U. S. G. S. Mon. XIII (pp. 277 and 278).

Photo No. 4. "Arsenic" and "Ems" springs, at Highland Springs, Lake County, California.

Bibl.: R. VI, Part I, p. 62; VIII, p. 328; XII, p. 336; XIII, p. 511; R. of M., Lake County, p. 6; U. S. G. S. Bull. No. 32, pp. 205, 212; Water Sup. Pap. 338, pp. 183–185; ANDERSON (op. cit.), pp. 169, 175.

Hoppin Estate. There are two springs on land owned by the Hoppin Estate, adjoining the Bartlett Springs property. They are about 100 eet apart, and about 100 yards from Bartlett's "soda-magnesia." They are not utilized at present, except locally. These are the two springs included in Register of Mines of Lake County (p. 5) under Bartlett, as "Iron, No. 4" and "Magnesia, No. 5." Their temperatures are: "magnesia," 60° F.; "iron," 59°.

Bibl.: U. S. G. S. Water Sup. Pap. 338, p. 201.

Hough Springs. These springs are on the main Williams-Bartlett stage road, 8 miles east of the latter. in Sec. 10, T. 15 N., R. 7 W., elevation 1800 feet (bar.). They are on the north fork of Cache Creek, at a point where the canyon widens out into a flat of several acres in extent. The springs are on the hillside near the hotel, the two principal ones being: ''soda,'' 60° F.; and ''iron and magnesia,'' 61°. Besides these, the well at the hotel is an ''iron'' water, and there is a ''white sulphur'' spring in the creek bank, below, not at present utilized. The hotel, cottages, and tents will accommodate about 150. The soda spring is an excellent ''seltzer'' water, with plenty of snap due to the large excess of carbonic acid gas; and has a picturesque natural grotto around it (see photo No. 10). None of the water is bottled. Bartels Bros. are the owners.

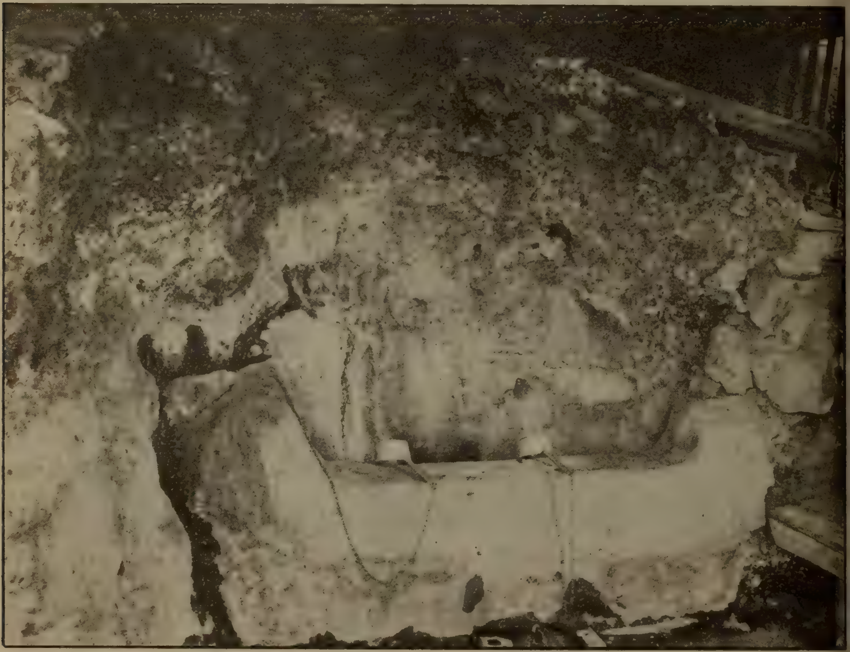


Photo No. 10. Soda Spring and Grotto at Hough Springs, Lake County, California.

Bibl.: R. VI, Pt. I, p. 63; R. of M., Lake County, p. 6; U. S. G. S. Bull. No. 32, p. 206; Water Sup. Pap. 338, p. 197; ANDERSON (op. cit.), p. 180.

Howard Springs. Howard Springs owe their name to their first locator, who took them up about 1871. They are owned by W. J. Laymance of Oakland, and R. J. Yates is lessee. They are in Sec. 30, T. 12 N., R. 7 W., 7 miles southwest of Lower Lake, and 14 miles orthwest from Middletown, at an elevation of 2150 feet (bar.). hey are on the edge of a small basin, surrounded by rolling hills. here are something like forty separate flows, but fourteen of them, owever, being in active use. The principal ones are: "Excelsior" lithia), 79.5° F.; "Alum," 80°; "Alum-Sodium," 82°; "Borax," 86°; Twins," 82° and 102° ("Prince and Princess," about 7 feet apart); Eureka," 108°; "Hot Sulphur and Iron," 110°; "Old Man's Friend" Neptune in list of analyses), 87°; "Bohemian," 71°; "Soda," 65° about ¼ mile distant from others). Water from the "lithia," Eureka," and "Bohemian" were bottled at one time—previous to 911. There are accommodations for 80, mostly in cottages. The bath ouse utilizes the water from the hot iron and sulphur spring.

Bibl.: R. VI, Part I, p. 63; VIII, p. 328; XII, p. 337; XIII, p. 511; R. of M., Lake County, p. 6: U. S. G. S. Bull. No. 32, p. 206; Water Sup. Pap. 338, p. 95; ANDERSON (op. cit.), pp. 180 and 181.

Mills Springs (see *Castle Springs*).

Newman Spring. This place is known locally as "Soap Creek," on ccount of borax being a prominent constituent in the water. It is sed as a bathing resort, there being a walled-in swimming pool. It is ½ miles north of Bartlett Springs, in Sec. 35, T. 16 N., R. 8 W., and owned by Geo. Young of Bartlett Springs, being leased to W. W. allman.

Bibl.: R. X, p. 254; R. of M., Lake County, p. 6; U. S. G. S. Water Sup. Pap. 338, p. 202.

Pierson Springs (see *Saratoga Springs*).

Red Wing Spring (see *Spiers Springs*).

Richardson (see *Grizzly*).

Saratoga Springs (Pierson). About twenty years ago these springs ere known under the name of Pierson. The post office at the springs called Bachelor. They are in Sec. 4, T. 15 N., R. 10 W., 22 miles orth of east from Ukiah and 6 miles west of Upper Lake, at an elevaon of 1500 feet (bar.). John Martens Estate is the owner. The ow of the springs has not been measured, but it is stated that the rongest one can not be bailed out completely by hand with a 2-gallon ucket. No water is bottled for sale. There are 13 springs in use, the rincipal ones being: "magnesia" (No. 1), 59° F. and (No. 2) 61.5°;

''arsenic'' 60°; ''sulphur'' 60°; ''soda'' 61.5°; '' iron'' 61.5°; ''seltzer'' 59°.

Bibl.: R. VI, Part I, p. 63; VIII, p. 328; XII, p. 337; XIII, p. 511; R. of M., Lake County, p. 7; U. S. G. S. Bull. No. 32, p. 207; Water Sup. Pap. 338, p. 179; ANDERSON (op. cit.), pp. 220 and 242.

Seigler Hot Springs. This resort is owned by the Seigler Springs Company, with A. J. McGill, president; Robert Forbes, secretary, and W. H. Roberts, manager. It is in Sec. 24, T. 12 N., R. 8 W., 5 miles southwest from Lower Lake, 30 miles north of Calistoga, and at an elevation of 2230 feet (bar.). There is quite a variety of springs here, both cold and hot. The principal ones are: ''hot iron'' 107° F.; ''hot sulphur'' 107°; ''small sulphur'' 118.5°; ''big sulphur'' 126°; ''lithia'' 67°; ''soda'' 64° ''magnesia'' 72°; arsenic'' 94°; one not named 97°; ''geyser'' was choked up. At the ''Big Sulphur'' spring there is considerable excess gas escaping, and there is a large sinter deposit beside it. This spring is the principal one supplying the swimming pool (30 feet wide, 200 feet long, and 3 to 10 feet deep) made by damming the small ravine at the upper end of which several springs issue. Besides this, several of the other springs have stone bathhouses built over them, large enough for swimming exercise. The hotel is supplied with farm and dairy products from the ranch maintained as a part of the resort, comprising a total of 700 acres. There are accommodations for 250 people. No water has been bottled for sale, but it is stated that they contemplate doing so. There is a body of light

Photo No. 17. Hotel at Seigler Hot Springs, Lake County, California.

olored, volcanic tuff a short distance from the hotel, which has been sed for building purposes around the resort, including the main dining oom and a part of the hotel (see photo 17).

Bibl.: R. VI, part I, p. 63; VIII, p. 328; X, p. 230; XII, p. 337; XIII, p. 511; R. of M., Lake County, p. 7; U. S. G. S. Bull. 32, p. 207; Water Sup. Pap. 338, pp. 96–98; Anderson (op. cit.) p. 243.

Soap Creek (see *Newman*).

Soda Bay Springs. At Soda Bay on the west shore of Clear Lake, miles northeast of Kelseyville, are a number of ‘‘soda’’ springs, both n shore and out in the lake. One, particularly of note, out in the lake, y reason of the large excess of carbonic acid gas escaping raises the evel of the water about a foot over an area of a square yard. These prings are not utilized except locally.

Bibl.: R. VIII, p. 328; X, p. 242; R. of M., Lake County, p. 7; Anderson (op. cit.) p. 245; U. S. G. S., Water Sup. Pap. 338, pp. 191–192.

Spiers or Red Wing Spring (Copsey). This was originally known as Copsey's Spring, from the locator. The land adjacent to the spring nd the riparian rights have been in litigation between Joshua Spiers nd M. Hoberg (of Cobb post office); and at the time of our visit both were bottling water from the spring, under the name of ‘‘Spiers’’ and ‘‘Red Wing,’’ respectively. The temperature of the water is 80° F. The hotel is owned and operated by Hoberg. There is a second, smaller pring near-by not utilized. They are on Seigler Creek, on the opposite ide from the stage road, 8 miles west of north from Middletown, in Sec. 5, T. 11 N., R. 7 W., elevation 1380 feet (bar.).

Bibl.: R. of M., Lake County, pp. 5 and 7; U. S. G. S., Water Sup. Pap. 338, p. 190.

Sulphur Bank (see under *Quicksilver*).

Witter Springs. The first authentic record of use of these springs by white men in 1862. They are in Sec. 5, T. 15 N., R. 10 W., 21 miles east of Ukiah and 7 miles west of Upper Lake, at an elevation of 1800 feet (bar.). The property is owned by Witter Medical Springs (Inc.), W. F. Detert, president, and W. C. Marsh, secretary, with offices at 311 California street, San Francisco. There are several springs, all cold, but the principal one, ‘‘Witter,’’ is purely a medicinal water, owing to its high mineral content (1019 grains per gallon), and cannot be used freely. This is the one which has been bottled up to the present time. The ‘‘Humming Bird’’ spring is practically fresh water, having only 24 grains of mineral per gallon, and it is proposed to blend some of this with the "Witter" water and bottle it, carbonated, for table use. Witter water is put up in a special 24-ounce bottle, and packed 36 in a case. There is a fine, large hotel here of 113 rooms; and there are 15 cottages.

Bibl.; R. VI, Part I, p. 64; VIII, p. 329; XII, p. 337; XIII, p. 511; R. of M., Lake County, p. 7; U. S. G. S. Bull 32, p. 209; Water Sup. Pap. 338, pp. 177–179; ANDERSON (op. cit.) p. 265.

In addition to the springs described above there are innumerable mineral springs in the county, both on unlocated ground and on patented land, which are not utilized at present or at least only privately. Among these may be mentioned the following:

"Alum" Springs, in Sec. 11, T. 14 N., R. 7 W., Hiram Kennedy, Lower Lake, owner.

Astorg, near Glenbrook, in Sec. 28, T. 12 N., R. 8 W.

Chalk Mountain, carbonated springs on Chalk Mountain, 11 miles east of north from Lower Lake, near the Dinsmore and Alum.

Dinsmore (soda and iron) in Sec. 11, T. 14 N., R. 7 W., R. Dinsmore, Lower Lake, owner.

Elliott (soda and iron) near Highland Springs, in Sec. 8, T. 12 N., R. 9 W., C. C. Hopkins and C. E. Miller, owners.

England (same as Elliott).

Glen Alpine, on west bank of Scott Creek, 6 miles southwest of Lakeport, on the Hopland road.

Gordon, in Sec. 20 T. 11 N., R. 7 W., Estate of E. A. Hoffman, owner.

Hayvilla Sulphur Spring, 5 miles northwest of Upper Lake.

Kelseyville (soda), in Sec. 14, T. 13 N., R. 9 W., Farmers' Savings Bank, Lakeport, owner.

Lee Soda, in Sec. 33, T. 14 N., R. 10 W., J. F. Lee, Lakeport, owner.

Lyons, Mrs. J. H. Lyons, owner; 6 miles north of Lakeport.

McIntyre Ranch, 6 miles from Kelseyville; an iron spring. Murdock McIntyre, owner.

Morton (See *Roaring Soda*).

Paramore (soda and iron), near Upper Lake in Sec. 21, T. 17 N., R. 9 W., E. R. Smith, owner.

Quigley Soda Springs. On the Quigley ranch at Arabella.

"Roaring Soda" (also called *Morton*), near Hullville, in Sec. 15, T. 18 N., R. 10 W., J. M. Macdonough, owner. Used by occasional camping parties.

Royal, in Sec. 7, T. 16 N., R. 8 W., Dr. E. S. Holway, Colusa, owner.

Spring Hill Farm Resort, a small "iron and magnesia" spring in Sec. 8, T. 10 N., R. 8 W., near Middletown, L. S. Peterson, owner.

Sulphur Spring, near Blue Lakes Resort.

At Upper Lake, water for domestic purposes is obtained from numerous artesian wells. They all carry more or less mineral, principally iron and soda.

The surface water is stated to stand at about 6 feet depth, and the artesian stratum at about 50 feet. West of town the two string bean canneries use artesian wells for irrigating. One of them (Mendenhall's) has sixteen wells on 100 acres; and it is said that when these sixteen (about ½ mile distant) are flowing that the flow of the wells in town is noticeably lowered. A mile south of town on the Taylor place there is a very vigorous artesian "soda" well, with considerable excess gas. It is capped, and not utilized at present.

On the road from Lower Lake to Knoxville, three or four mineral springs were passed, one of them called *Baker Soda Spring.* They are not utilized. Two of them had large calcareous sinter deposits below them.

Bibl.: R. X., pp. 230 *et seq.*, R. of M., Lake County, pp. 5–7; U. S. G. S. Bull. 32, pp. 203, 205, 208, 209; Water Sup. Pap. 338, pp. 93, 181, 182, 186, 188, 196, 197, 202–204, 268, 358; Anderson (op. cit.) pp. 164, 176, 247, 267, 269.

NATURAL GAS.

At Kelseyville is a gas well, which was used for a time for illuminating purposes; but the gas was not dried, and it is stated that acid in the moisture corroded the supply pipes. The gas flow was struck at a depth of 158 feet. The buildings connected with it were burned, and have not been rebuilt. The gas is also said to have been tried in a gas engine. It is not utilized at present; and the well is capped.

Bibl.: R. VII, p. 184; VIII, p. 326; X, pp. 241, 271; XI, p. 63; Anderson (op. cit.) pp. 182, 266–269; U. S. G. S., Water Sup. Pap. 338, p. 181.

ONYX.

There is a small undeveloped deposit of "onyx marble" in Sec. 12, T. 18 N., R. 10 W., near Hullville.

Bibl.: Reg. of Mines, Lake County, p. 3.

PETROLEUM.

There are oil seepages reported on the east, southeast and northeast of Morgan Valley, in the southeastern part of Lake County. The valley has flat-lying sandstones, and it is thought they "may have oil underneath."

Some of the seepages have been prospected, and a small amount of high grade oil (paraffine base) said to have been obtained. Some light oil was found a few miles southeast of here, in the Knoxville quicksilver mine, on the 400-foot level at the sandstone contact, and was used as a lubricant around the mine machinery.

QUICKSILVER.

Prospecting and exploitation of quicksilver deposits in Lake County began in the early sixties, and the Abbott mine was a producer as early as 1870. There was no notable production, however, until 1873. As will be noted by reference to the Table of Mineral Production, quicksilver mining was most active in this county from 1875 to 1882. The high-water mark in the price of quicksilver in California was reached in 1874 (the highest quotation being $118.55 per flask), with $105.18 the average San Francisco figure for that year. This was preceded by an average of $80.33 in 1873, and followed by $84.15 in 1875. The following year it dropped to $44. The low record sales price was $25.25 in 1879, but 1882 was the lowest year, with average of $28.23. The average price for 1913 was $40.23.* The variations in the market price of quicksilver have been decidedly erratic, as will be noted by reference to the table in Bulletin 27, page 10.

There was a revival of quicksilver mining in Lake County between the years 1891 and 1896; but beginning with 1905 there has been a rapid decline, until at the present time it has reached an almost insignificant figure. There were but two producers in 1913—the Helen and the Wall Street, both of them being near Middletown. It may be noted here that in some of the early reports and press notices the Knoxville mines (Manhattan, Lake, Redington, Boston) were erroneously referred to as being located in Lake County. They are in Napa County.

The principal consumption of quicksilver is in the manufacture of fulminate for explosive caps, in the recovery of gold and silver from their ores by amalgamation, the preparation of certain drugs, and the manufacture of vermilion, of electric lighting apparatus and scientific

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*The average price for the first seven months of 1914 was $38.61, the monthly figure varying between $39.25 for January and $37.50 for July. The outbreak of the war in Europe in August at once changed the aspect of the quicksilver situation, as it did many other lines. The monthly averages to date since that have been as follows:

August, 1914	$80 00
September	76 25
October	53 00
November	55 00
December	53 10
January, 1915	51 90
February	60 00
March	78 00
April	77 50
May	75 00
June	90 00
Closing June figure, per flask	90 00

W. W. B., July 1, 1915.

apparatus. A new and interesting use now coming into vogue is for "floating" the revolving lights of lighthouses. About 600 pounds of quicksilver are required (depending on the size of the light)—being placed in a circular groove or channel. The lighting unit is set on a pontoon which, in turn, rests and revolves on the mercury. As the metal is not consumed, the loss after installation is insignificant.

In "Mineral Resources of the United States for 1912" H. D. McCaskey says:

> Owing to the generally low prices prevailing, the domestic quicksilver industry was not particularly prosperous in 1912. The great majority of the producers are operating old mines in which high grade ore is now rarely encountered, and there was no new rich ore shoots reported for the year. In most cases special skill is required to prevent the plants running at a loss. * * * Although each well-developed property is equipped with its own plant and presumably run at lowest costs, the margin of profit in many cases is so small upon low-grade ores that during periods of low prices the mining activity is likely to be considerably curtailed. * * * It is true that further improvements in metallurgical treatment, particularly in preventing furnace losses, should result in a better margin of profit. But little improvement can be made with low market prices and uncertainty of ore supplies. The domestic market for quicksilver appears to demand from 20,000 to 25,000 flasks for consumption per annum. The foreign market is not profitable to American producers in competition with large European supplies available at lower prices. At low prices and normal output there is little importation, but at high prices importation of foreign supplies reacts to curtail output by cutting prices to a low margin of profit. It would seem, therefore, that unless rich ore, workable under favorable conditions at a large profit, be available, or industrial chemistry find new uses for the metal and an increase in domestic demand results thereby, the present producers must continue to operate under somewhat unfavorable conditions, and new producers and small mines must compete with established mines and plants now operated presumably at minimum costs and with special skill and knowledge of the art.

The increasing adoption of the cyanide process in place of amalgamation in the treatment of gold and silver ores, has materially decreased the demand for quicksilver of recent years, particularly in the western United States and in Mexico. The present low tariff, of $5.25 per flask, also affects domestic prices. (See Min. Res. of U. S., 1911, Part I, p. 917.)

As to metallurgical improvements in the reduction of quicksilver ores, besides those looking to the prevention of furnace losses, the question of concentration will no doubt play an important part in the near future. Egleston ("The Metallurgy of Silver, Gold and Mercury in the United States, Vol. II, 1890, p. 804") says: "The attempts of mechanical concentration of quicksilver ores have usually not been successful, because cinnabar is so friable that a greater portion floats off with the water." Just there has been the mistake—too fine crushing or grinding. *Grinding* should be avoided. In the writer's opinion rolls are best adapted for crushing cinnabar bearing ores, as they give a better average product with a minimum of fines. G. V. Northey at the Manzanita mine at Sulphur Creek, Colusa County (see Bull. 27, pp. 198-202; also Eng. and Min. Jour. Vol. 96, p. 783), proved conclusively that cinnabar can be concentrated successfully and handled economically, even using so crude a device as the old Gilpin County bumping table. Also, at the present time, concentration is being practiced at both the Ætna and the Oat Hill mines in Napa County (see under Napa County).

Of course, there are a number of details to be worked out, not only in the ore dressing end, but in the reduction of the metal from the concentrates. This material, because of its high specific gravity and its finely divided condition, packs in the retort and needs some sort of rabbling or shaking up to allow of a complete expelling of the quicksilver. So far only retorts have been used—both ''D'' and pipe. Possibly some form of a rotary roaster may be evolved; or, a small tile shaft furnace of the Hüttner-Scott type, but with a narrower shaft and a narrow ''shelf-slit.''* There are a good many quicksilver properties in California idle as well as operating, particularly in Napa, Lake and Sonoma counties, where it would seem worth while to investigate the feasibility of concentration. Then, too, there are the mines like the old Rattlesnake and the Socrates, in Sonoma County, whose ores contain a large percentage of native quicksilver. Some scheme of washing and settling, or concentrating would seem to be the solution of the problem of dressing these ores.

There are four recognized quicksilver districts either wholly or in part located in Lake County: (1) *Mayacmas,* the largest, is in southwestern Lake and extends over into northeastern Sonoma, and northwestern Napa; (2) *Clear Lake* district is around the eastern, southern and southwestern sides of Clear Lake; (3) *Knoxville* district is at the junction of Lake, Yolo, and Napa, being principally in the last named; (4) *Sulphur Creek* district is almost wholly in Colusa but includes the Abbott mine which is on the eastern edge of Lake County.

Bibl.: State Mining Bureau Reports IV, pp. 328-344; V, pp. 95, 96; VI, Part II, pp. 72, 73; VIII, pp. 324, 325; X, pp. 238, 239, 270; XI, pp. 61-65, 239; XII, p. 360; XIII, pp. 595-597; Reg. of Mines, Lake County, p. 3; Bull. 27, pp. 35-42, 46-72, 197-255. U. S. G. S. Mon. XIII; Min. Res. of U. S. 1883, pp. 389, 395; 1884, pp. 492, 494; 1888, pp. 97-99; 1891, pp. 117-121; 1892, pp. 138-168; 1902, pp. 251, 252; 1906, p. 497; 1907, Part I, p. 679; 1908, Part I, p. 686; 1909, Part I, pp. 552, 553; 1910, Part I, pp. 697, 698; 1911, Part I, p. 901; 1912, Part I, pp. 940-942; An. Rep. XVI, Part III, pp. 598, 599; XXI, p. 277.

GEOL. SURV. OF CAL., GEOLOGY, Vol. I, pp. 96-100; Vol. II, pp. 124, 125.

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*Since the above was written, the author has seen such a furnace in successful operation at the New Idria quicksilver mine in San Benito County, for treating soot instead of retorting it. The tile aperture is 3-inch instead of 6-inch as in the larger furnaces. This furnace has a capacity of 9 tons, and 8 tons of fine ore are mixed with each ton of dried soot on charging.

Min. Res. West of Rocky Mts., 1868, p. 266; 1873, p. 11; 1874, pp. 30 *et seq.;* 1875, pp. 13-20, 173-178, 493; 1876, pp. 18-21.

Trans. A. I. M. E. XXII, p. 86; XXIII, pp. 225 *et seq.;* XXXIII, p. 751; Genesis of Ore Deposits, pp. 32, 66, 256.

Richard's "Ore Dressing," Vol. II, p. 1074.

Min. and Sci. Press, May 27, 1905. Eng. and Min. Journal, Vol. 96, pp. 783, 828.

American Jour. of Science, Vol. XXIV, 3d Series, pp. 23 *et seq.*

An extended bibliography on quicksilver for North America is given in Mineral Resources of the United States 1910, Part I, pp. 705-710; 1911, Part I, p. 920.

Abbott Mine. The Abbott mine is on the eastern border of Lake County, in Sec. 32, T. 14 N., R. 5 W., about 1 mile in an air line and 2 by the road from Sulphur Creek post office, Colusa County. It was formerly operated by the Empire Consolidated Quicksilver Mining Company. Jas. H. Boyer, 1106 Merchants' National Bank Building, San Francisco, R. A. Boggess et al. are owners; but the property has been in litigation for some time, and apparently is still unsettled. The plant was shut down in 1906, after having been in operation (the last period) for about sixteen years. The mine was discovered in 1862, and began production in 1870, continuing to 1879. It was idle from 1879 to 1889. The Disturnell is included with the Abbott in the property. The mine is credited with a total production of 30,465 flasks. The underground workings are quite extensive, the greatest depth, however, being only 350 feet below the collar of the "Boggess" shaft. As the mine and adjacent ground has been fully described in several reports previously published, and there being no new developments since, details of the geology will not be entered into here, except to recall to notice the occurrence of a light, inflammable hydrocarbon gas in considerable quantities here, an unusual feature among metal mines (at least, as regards quantity), though other hydrocarbons, and bitumens are not uncommon in quicksilver mines. The reduction equipment consists of a 48-ton Scott furnace, with an ore drier located between the crusher and furnace.

Bibl.: R. IV, p. 336 (Table); XI, p. 239; XII, p. 360; XIII, p. 595; Bull. 27, pp. 46-48; R. of M., Lake County, p. 3; U. S. G. S. Mon. XIII, p. 368; Min. Res. of U. S. 1902; GEOL. SURV. OF CAL. GEOLOGY, Vol. II, p. 124; MIN. RES. W. OF ROCKY MTS. 1876, p. 19.

American (see *Helen*).

Anderson Prospects, owned by members of the Anderson family of Anderson Springs. They are in Secs. 25 and 35, T. 11 N., R. 8 W., near Middletown, but have not been developed.

Bibl.: Bull. 27, p. 48.

Bacon, abandoned. R. of M., Lake County, p. 3; Rep. IV, table op. p. 336.

Baker Mine. In Sec. 16, T. 12 N., R. 6 W., 6 miles southeast of Lower Lake. It is owned by the Baker Quicksilver Mining Company. No work, except annual assessments has been done for several years.

Bibl.: R. XI, p. 67; XII, p. 360; XIII, p. 595; R. of M., Lake County, p. 3; U. S. G. S. Mon. XIII, p. 368; GEOL. SURV. OF CAL. GEOLOGY, Vol. II, p. 125.

Bear Canyon (see *Thorn*).

Big Injun Group, the *Big Injun* of the New Phoenix Mining Company and the *Digger Injun* of the Congress Mining Company, have been idle for several years. They are west of Middletown, and near the Helen mine.

Bibl.: Bull. 27, p. 50.

Bradford (see *Mirabel*).

The *Bullion* mine is 4 miles southwest of Middletown, between the Mirabel and Great Western, Ralph H. Read, Middletown, owner. It was formerly worked by the Mirabel Company, and had been abandoned for several years, but was relocated in August, 1913.

Bibl.: R. XII, p. 360; XIII, p. 595.

Chicago Mine (Ural). This property is owned by the Chicago Quicksilver Mining Company, 522 Bank of San Jose Building, San Jose, Cal. It is in Sec. 1, T. 10 N., R. 8 W., about ½ mile west of the Wall Street mine, near Middletown. It has been idle for some time. The last operations here were in 1911 on the construction of a fine-ore furnace of 15 tons capacity, with concrete walls. The furnace was not finished, and consequently never operated. It would be interesting to note the behavior of the concrete when heated. It looks to be an experiment with rather a doubtful outcome.

Bibl.: R. XIII, p. 595; Bull. 27, p. 51; R. of M., Lake County, p. 3; U. S. G. S. Min. Res. of U. S. 1909, Part I, p. 552; 1910, Part I, p. 697; 1911, Part I, p. 901; 1912, Part I, p. 940.

Destinell (see *Abbott*).

Digger Injun (see *Big Injun Group*).

Franklin (see *Jewess*).

Great Western Mine. The Great Western mine is 4 miles southwest of Middletown, 2 miles northwest of the Mirabel, at an elevation of 1860 feet. This mine had the longest continuous record as a producer of any quicksilver mine in Lake County. It was opened up in 1873, and was a constant producer up to 1909. It is credited with a total yield of 98,296 flasks. The last quicksilver produced by this mine was a few flasks recovered in 1912 in cleaning up around the old furnaces. The company has been disincorporated, the furnaces torn down, and the mine abandoned as being worked out. As might be expected from its output record, the Great Western has extensive underground workings, and to a depth of 750 feet. The mine and its geology are described at some length in the reports noted under Bibliography. The property was equipped with a 40-ton Litchfield furnace.

Bibl.: R. X, p. 270; XI, p. 64; XII, p. 361; XIII, p. 595; Bull. 27, pp. 52, 53; R. of M., Lake County, p. 3; U. S. G. S. Mon. XIII, pp. 358-362, 470; Min. Res. of U. S. 1883, 1884, 1892, 1902, 1906, 1907, Part I, 1908, Part I; 1909, Part I; 1910, Part I; 1912, Part I; MIN. RES. WEST OF ROCKY MTS., 1874, 1875, 1876.

Helen Mine (*American*). The Helen mine, owned by Andrew Rocca, is in Sec. 1, T. 10 N., R. 8 W., 6 miles west of Middletown, at an elevation of 2675 feet (barometric reading at bottom of furnace). It consists of two claims, the Helen and the Austin, which were patented in 1874 by Pushbecker, later sold to the American company and to the present owner in 1900. The property includes between 600 and 700 acres (partly timbered) besides the mineral claims' area. The timber, somewhat scattered for the most part, consists of pine, oak, madrone and ''fir.'' The mine is at the head of the north branch of Dry Creek. Its first recorded production was 128 flasks in 1873. The mineralized ledge is 100 to 200 feet wide, in serpentine, and has a black gouge on the hanging-wall. The vein outcrop is prominent, and strikes a little north of west, dipping to the south at 30° to 40°. There are two main levels at present operated, both being by tunnels, one of which is in 2000 feet giving a depth of 316 feet below the outcrop. They have two ore-shoots—one on the footwall side 100 feet long by 40 feet wide on which they have gone down 90 feet; and one on the hanging, 200 feet long by 40 feet wide. The ledge has been proven underground by drifting, for 1000 feet in length. The ore is cinnabar, intermixed with more or less pyrite, and occurs in seams, sometimes an inch or two thick, of solid cinnabar. These seams are approximately parallel to the ledge, and are crossed at high angles by other and rather minute ore seams. The serpentine is in part silicified and carries lenses of hard, fine-grained black "jasperoid."

At the time of our visit (August, 1913), both the mine and the furnace were in operation, with 16 men, all told, at work—9 underground, 3 on top, and 4 on the furnace. On the outcrop some good ore was being stoped out to the surface. The furnace is a 50-ton Scott (see photo No. 19), and has special condenser arrangements designed by Mr. Rocca, in which the draft is controlled by dampers. It is said to work satisfactorily. The owner states that the ore being reduced averages 0.6 per cent quicksilver, and that he can handle at a profit ore carrying down to 0.25 per cent of the metal. Soot from the condensers, and occasional small lots of rich ore are treated in "D" retorts of 1000 pounds per day capacity. A small gasoline engine, run intermittently, furnishes power for the rock breaker. The furnace consumes 1¼ cords of firewood per twenty-four hours. The ore is trammed, horse-drawn, from mine to furnace in trains carrying 3 tons per trip. As the upper parts of the mine are difficult to work on account of water in the wet season, only development work on the lower levels is done in winter. The mine is credited with a total production of something over 5000 flasks to date.

Photo No. 19. Fifty-ton Scott furnace at the Helen Mine, near Middletown, Lake County, California. Old dumps of the Wall Street Mine in the distance.

Bibl.: R. XII, p. 362; Bull. 27, p. 55; R. of M., Lake County, p. 3; U. S. G. S. Mon. XIII, p. 375; Min. Res. 1902, 1907, Part I; 1908, Part I; 1909, Part I; 1911, Part I; 1912, Part I, pp. 940–942; MIN. RES. W. OF ROCKY MTS. 1874, p. 30.

Jewess Prospect (*Franklin.*) It is near the Helen and Wall Street mines, but so far as known has never produced any quicksilver. It has been idle several years.

Bibl.: Bull. 27, p. 157.

King of All Group. This group owned by Lem Stanley of Lower Lake is in Secs. 29 and 32, T. 12 N., R. 7 W., about 10 miles north of Middletown and 1 mile southeast from Howard Springs. None but assessment work has been done for several years. The geology is described in Bulletin 27.

Bibl.: Bull. No. 27, p. 57; R. of M., Lake County, p. 3; U. S. G. S. Min. Res. 1912, Part I, p. 940.

Lucitta Mine (*Uncle Sam*). The Lucitta group of four claims (also known locally as the Uncle Sam), is owned by the Mount Sam Mining Company, and is located on the south slope of Mount Konocti (or Uncle Sam), in Secs. 20 and 21, T. 13 N., R. 8 W., about 7 miles southeast of Kelseyville. The mine has not been worked recently nor has it reported any production for several years past. The geology is described in Bulletin 27.

Bibl.: R. V, p. 96; Bull. 27, p. 58; R. of M., Lake County, p. 3.

The *Maypole* prospect, 7 miles west of Middletown has been abandoned.

Bibl.: R. XIII, p. 596.

The *Middletown* prospect, half a mile southwest from the Jewess, has been abandoned.

Bibl.: Bull. 27, p. 59.

Mirabel (*Bradford*) *Mine.* This mine was first opened up in 1887, as the Bradford, and later renamed Mirabel, being owned by the Standard Quicksilver Company. It is 4 miles south of Middletown. For ten years it was one of the important producers of Lake County, but in 1897 was abandoned as worked out; and the mine has filled with water. In 1908 a small production was reported as having been made from a clean-up around the old furnace. The property has yielded a total production of about 30,600 flasks. Underground, a vertical depth of 500 feet was reached, with 22,500 linear feet of drifts, and 750 feet of shaft work. More extended descriptions of the mine and its geology will be found in the references noted under Bibliography.

Bibl.: R. VIII, p. 325; X, p. 270; XI, p. 64; XII, p. 361; XIII, p. 595; R of M., Lake County, p. 3; U. S. G. S. Mon. XIII, p. 375; Min. Res. 1888, p. 97; 1891, p. 117; 1892, p. 160; TRANS. A. I. M. E., XXII, p. 86.

Red Elephant. This prospect, owned by W. G. Tremper of Lower Lake, is in Sec. 3, T. 11 N., R. 5 W., near the Napa County line, ½ mile west of Knoxville. Only sufficient development, mostly surface work, has been done to cover annual assessments.

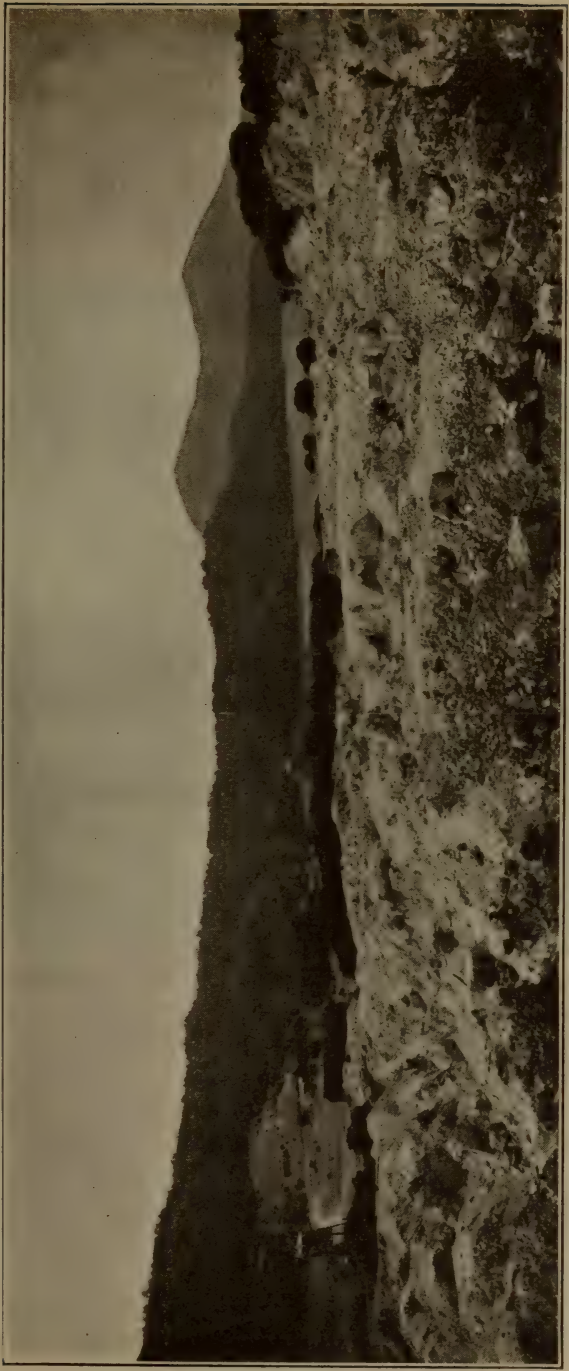
Bibl.: Bull, 27, p. 92; R. of M., Lake County, p. 3.

Shamrock Prospect. This group of two claims is on Rocky Creek, a branch of Cache Creek, in Sec. 23, T. 13 N., R. 6 W., about 10 miles northeast of Lower Lake. It is owned by the Shamrock Development Company (Jas. Daly, W. P. Swift et al.), Napa. The property is idle.

Bibl.: Bull. 27, p. 60; R. of M., Lake County, p. 3.

Standard (see *Mirabel*).

Sulphur Bank Mine. This mine is one of the notable and much written about quicksilver mines of the world. It is extremely interesting from many standpoints—those of chemistry, mineralogy and geology, as well as metallurgy and mining. It was first worked in 1865 for sulphur, and in the four years to and including 1868 produced a total of nearly 2,000,000 pounds of that mineral, valued at $53,500. The property was at that time owned by the California Borax Company which during the same period was also producing borax from Borax Lake, near-by. The two are still intact, being owned at present by W. S. Tevis, of San Francisco, and leased out as part of a cattle range. During the time of working the surface cuts for sulphur, some difficulty was experienced in refining the material because of the presence of cinnabar, which darkened the product. The proportion of cinnabar increased with depth. Cost of transportation to the market and a rapid fall in the price of sulphur caused a cessation of operations, but the mine was reopened and developed for its quicksilver in 1873, being a steady and important producer until 1883. After four years of idleness, work was resumed and continued until 1897, when it was again shut down. In 1899 the mine was reopened and worked until December, 1905, the shaft being kept unwatered until June, 1906, since which time it has been idle. As a producer of quicksilver, the Sulphur Bank mine is credited with a total output of 92,000 flasks. It is said that at the time of the last closing down of the mine (due to financial



Panoramic photo. Sulphur Bank Mine, Lake County, California, from eastern wall of old open cuts. Mt. Konocti in right distance.

troubles as well as the increasing difficulties of ventilation and pumping in consequence of the hot waters and deleterious gases) they had opened up a good body of high grade ore underground from the Empire shaft.

The Sulphur Bank is a low, rounded hill (see photo No. 22), on the eastern shore of Clear Lake in Sec. 6, T. 13 N., R. 7 W., about 10 miles north of Lower Lake. It is also reached by launch from Lakeport. The elevation is 1350 feet at the lake level. The old surface cuts much resemble those of a placer mine with its tailings piles of boulders, except that over it all is a pulverulent, white powdery material, the result of the continuing decomposition of the rocks by the solfataric vapors and waters still present (see panoramic photo). The glare is almost blinding on a sunny day. The rounded boulders due to concentric decomposition, as described by Becker (U. S. G. S. Mon. XIII) can be plainly seen. The evidences of solfataric activity are numerous and striking. Iron rails, nails, cables, etc., are sulphurized and oxidized. Wood is blackened and rotted. There are abundant sulphur crystals in crevices and flour sulphur around vents where vapors are issuing. At the mouth of an abandoned shaft, now caved, near the eastern edge of the surface workings (either the Hermann shaft or Hermann air shaft—see map, Bull. 27, p. 63), hot, moist, sulphurous gases are still escaping, and under a noticeable pressure. The odor of sulphur dioxide is very strong, so that it was difficult to breathe while placing a thermometer in one of the openings to observe the temperature. It showed 108° F.—this being at the surface. Becker (op. cit., p. 259), recorded temperatures up to 176° F. at a depth of

Photo No. 22. Sulphur Bank Mine from lake side.

300 feet. The rocks about the opening and protruding sticks of timber are heavily coated with a deposit of flour sulphur. There is a sound as of a roaring furnace from below. How any one could breathe in such an atmosphere, much less work, is a matter for wonderment. There was a dead rat lying at one of the openings. At the upper end of the "Western Cut," there are a number of warm springs with considerable excess gas escaping with the water—the whole having the appearance of a series of boiling cauldrons. (Photo No. 25). The appearance is deceiving, however, as the temperatures are much lower than one would expect. The following temperatures were obtained: 84° F.; 108° (water inky, with a black deposit forming about it); 100°; 97° (in upper corner). The Empire shaft (the latest sunk), was filled with water to within 15 feet of the collar at the time of my visit (August, 1913), and escaping gases were bubbling up through the water. "The gases escaping from the waters are carbon dioxide, hydrogen sulphide, sulphur dioxide, and marsh gas. The waters contain chiefly carbonates, borates, and chlorides of sodium, potassium and ammonium; but alkaline sulphides are also present." (Becker, op. cit., p. 463.)

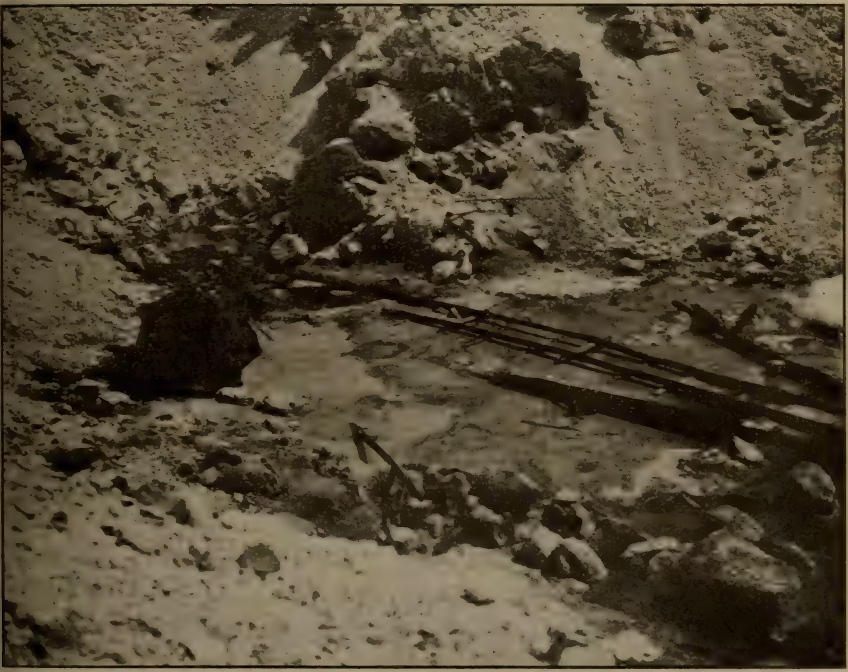


Photo No. 25. Hot springs in bottom of "Western Cut," Sulphur Bank Mine, Lake County, California.

As to the mode of occurrence of cinnabar at Sulphur Bank, it is well summarized by Becker (op. cit., p. 257), as follows: "It does not occur in sensible quantities at or near the surface, but is found to a considerable extent mixed with sulphur in the lower portion of the zone of oxidation. The principal deposits are below this level. They are found in the more or less decomposed basalt, in the underlying recent lake bottom, and in the Knoxville shales and sandstones. The cinnabar is associated chiefly with silica, in part crystalline and in part amorphous. In the lava it appears as small seams, which commonly follow either the original cracks between the blocks or the concentric surfaces of the decomposed masses. In the lake deposits below the basalt the cinnabar is found as impregnations or irregular seams. In the workings from the Hermann shaft the ore occurs exactly as it does in most of the quicksilver mines of California, more or less completely filling interstices in shattered rock masses. * * * Dr. Melville has found small quantities of gold and copper in the marcasite accompanying the cinnabar. * * * The intimate association of the ore with the sulphur, opal, quartz, pyrite, and to a smaller extent with calcite, is amply sufficient to show that it has been deposited from water." Also (p. 263): "Excepting for the solfataric springs the underground mine at Sulphur Bank resembles the other principal quicksilver mines of California. * * * This fact is an important one, for it proves that deposits indistinguishable from those found in the Redington, New Almaden, and other mines may be formed in the same manner as those at Sulphur Bank, by precipitation from hot springs of volcanic origin."

The property was equipped with a Knox-Osborne 25-ton furnace, 3 Hüttner-Scott furnaces of 40, 17 and 30 tons, respectively, and a battery of 9 "D" retorts.

At the "Little Sulphur Bank," above ½ mile south of Borax Lake, some prospecting has been done. Here, the same sulphurous odors are noticeable as at Sulphur Bank.

Bibl.: R. IV, pp. 157, 330, 339; V, p. 96; VI, Part I, p. 136; VIII, p. 324; X, pp. 238, 239; XI, p. 63; XII, p. 363; XIII, p. 597; Bull. 27, pp. 61–70; R. of M., Lake County, p. 3; U. S. G. S. Mon. XIII, p. 251–270, 463; Min. Res., 1883, pp. 394–397; 1884, p. 492; 1892, pp. 146, 148, 160; 1902, pp. 251, 252; Water Sup. Pap. 338, pp. 98–99; GEOL. SURV. OF CAL., GEOL., Vol. I, p. 99; TRANS. A. I. M. E., XXIII, pp. 225 *et seq.*; XXXIII, p. 751; Genesis of Ore Dep., pp. 32, 66, 256; MIN. RES., W. OF ROCKY MTS., 1868, p. 266; 1876, p. 20; AM. JOUR. OF SCI., Vol. XXIV, 3d Ser., pp. 23 *et seq.*

Thorn Mine (*Bear Canyon*). It is west of Middletown, in Sec. 36, T. 11 N., R. 8 W., near Anderson Springs. H. W. Herrick of Middletown is the owner. Only assessment work has been done for several years past, but it is said no ore bodies of any consequence have been developed. In 1909, a small production was reported from ore taken out during development work.

Bibl.: Bull. 27, p. 70; U. S. G. S. Min. Res. 1909, p. 552.

Uncle Sam Mine (see *Lucitta*).

Ural Mine (see *Chicago*).

Utopia Mine. The Utopia is on the eastern shore of Clear Lake in Sec. 25, T. 15 N., R. 9 W., near Bartlett Landing, northeast from Lakeport. It is owned by the Utopia Quicksilver Mining Company of Lakeport, A. Spurr, secretary. It has not been operated recently, as it is said they were driven out by water, the ore body running under the lake.

Bibl.: R. XIII, p. 597; Bull. 27, p. 70; R. of M., Lake County, p. 3.

Wall Street Mine. This mine was a producer as early as 1875, about which time it was patented, but abandoned by the original owners in 1878. The present owner, W. H. Parsons, acquired the property in 1898, by purchase of tax title from the state, and has been reporting an output of a few flasks of quicksilver annually for the past seven years. It is located in Sec. 1, T. 10 N., R. 8 W., on a branch of Dry Creek, 6 miles west of Middletown. The elevation is 2275 feet (bar.) on the road at the retort. The old workings are largely inaccessible. The owner works the mine single-handed, assisted by a pack-horse for handling ore, timbers and firewood. The Wall Street mine is about $\frac{1}{2}$ mile down the canyon from the Helen from which it appears to have been broken by a northeast-southwest fault. Their main mineralized ledges have several characteristics in common and are marked by the same prominent outcrop. The Wall Street, however, has a considerable proportion of native quicksilver which does not appear at the other. There is a narrow quartz vein in the main ledge near its hanging-wall side, and parallel to its dip—30° SW. The vein, which has a comb structure, carries in its numerous cavities and pores much native metal. Parsons states that the serpentine from 1 to 3 feet above and below the quartz carries some 4% of both native metal and cinnabar in about equal proportions. The silicified ore-bearing serpentine lies above the softer serpentine and carries the quartz vein, cinnabar, pyrite, and lenses of jasperoid. In the mill there is a 20 h.p. Westinghouse compressor (being a locomotive air-brake pump, 9½-inch diameter by 10-inch stroke), steam driven, which furnishes power for an air hammer drill in underground work. There is also a small Chilian mill, and two homemade, table concentrators, said to have a capacity of

3½ tons per day. Some of the soft ore is concentrated, but the jasperoid and disseminated ores are retorted direct. One "D" retort is used—14 inches high, 30 inches wide and 8 feet long—which consumes 1½ cords of firewood per flask of quicksilver produced. This retort has a capacity of 600 pounds of ore per day. The old company is said to have expended $100,000 and produced 140 flasks. The total output to the end of 1913 has been about 300 flasks.

Bibl.: R. IV, p. 183; V, p. 96; VI, Pt. I, p. 110; XII, p. 362; XIII, p. 597; Bull. 27, p. 71; R. of M. Lake County, p. 3; U. S. G. S. Mon. XIII, p. 375; Min. Res. 1907, Part I, p. 679; 1908, Part I, p. 686; 1909, Part I, p. 552; 1910, Part I, p. 698; 1911, Part I, p. 901; 1912, Part I, pp. 940–942.

STONE INDUSTRY.

Except for occasional local uses, there has been no development of the stone industry in Lake County. The board of supervisors reported macadam to a value of $10,000 used on road work in 1908, but they have done nothing but minor repairs since that time. There is said to be a red volcanic rock near Lower Lake which makes an excellent macadam, particularly when mixed with some clay.

SULPHUR.

Sulphur Bank Mine. As has already been noted (see under *Quicksilver*), the Sulphur Bank mine was originally operated for sulphur, of which it produced some 2,000,000 pounds (in round numbers), valued at $53,500, in the four years 1865–1868, inclusive. In the upper portions of the oxidized zone sulphur was abundant, and the material was taken out by quarrying. The sulphur was extracted by sublimation in cast iron retorts, then further refined by treating, while melted, in iron kettles to remove the dark color due to the presence of cinnabar, and finally poured into moulds. Cost of transportation and the decreasing market price caused a cessation of mining for sulphur. There is still much of this material in evidence at the Sulphur Bank, today, but it is doubtful if it can be made economically available, in competition with the Louisiana product and that from Japan (which latter is practically pure in its natural state, and requires no refining for most commercial uses), at least not until cheap transportation is established. The same statement applies to the borax deposits of Borax Lake on the same property.

Bibl.: R. IV, p. 379; V, p. 96; VI, Part I, p. 136; VIII, p. 324; X, pp. 238, 239; XI, p. 63; XII, p. 410; XIII, p. 646; Bull. 38, p. 372; U. S. G. S. Mon. XIII, pp. 254, 463; Geol. Surv. of Cal., Geology, Vol. I, p. 99; Min. Res. W. of Rocky Mts. 1867, p. 187; 1868, p. 266; 1872, pp. 447–450.

MARIN COUNTY.

Field Work in November, 1913.

Exclusive of San Francisco County, Marin is the smallest county in California, having a land area of only 529 square miles. The Pacific Ocean is its western boundary, Sonoma County on the north and east, San Pablo and San Francisco bays on the east, with the latter and the Golden Gate on the south. Its topography is quite rugged and picturesque, with occasional small and fertile valleys. Its most prominent topographic feature is Mount Tamalpais which overlooks both bay and ocean region from an elevation of 2600 feet. Other notable features are Tomales, Drakes, Bodega and Bolinas bays, on the ocean side, and Richardson's Bay on the inland side. Angel and Belvedere islands are included in Marin County. The areas around San Rafael, Mill Valley, Sausalito, and intermediate points are popular suburban residence sections.

The mineral resources of Marin County, while limited numerically, are none the less important individually. They are mainly structural and industrial materials. In the order of their production to date (see table) they are: brick, stone industry, mineral water, granite, salt, and copper. Their total recorded output is $3,869,799 to the end of 1913.

In addition to the above, occurrences have been noted of asphaltum and petroleum, chrome, coal, jasper, garnets, manganese, and natural gas. Attempts have been made to exploit some of these, but without commercial success so far.

ASPHALTUM AND PETROLEUM.

Along the shore-line cliffs west of Bolinas from Duxbury Point north for a distance of over 3 miles there are several small occurrences of asphaltum which appear to be residues from oil seepages. The principal ones are at Duxbury Point, Bolinas Point and Abalone Beach. Specimens of the material were collected and have been placed in the museum of the State Mining Bureau. There are pebbles and rock fragments imbedded in the asphaltum (see photo No. 165).

At Abalone Beach there is said to be an oil seepage which is uncovered at extreme low tide, but the tide was not low enough to see it during my visit. The shales here dip to the south and east at a rather flat angle (20° to 30°). At the south end of this beach, and about 1¼ miles north of Bolinas Point, is an unconformity between two series of shales, the upper series being more massive than the other. The top of the lower series is marked by a thin layer of pebbles partially stuck together with asphaltum.

Table of Mineral Production.

Year	Brick		Stone industry		Mineral water		Miscellaneous and unapportioned	Value
	1,000	Value	Tons	Value	Gallons	Value		
1888	1,600	$10,000						
1889	*2,000	12,000						
1890	*5,000	30,000						
1891	*10,000	60,000						
1892	*12,000	72,000						
1893	18,000	108,000						
1894	28,500	172,500		$16,850				
1895	29,000	145,000		7,790			7,000 cubic feet granite	$5,000
1896	15,000	85,000	7,849	8,260				
1897	15,000	89,000	6,000	7,200				
1898	15,500	66,000	1,710	1,800				
1899	16,500	76,000	4,400	5,150				
1900	25,000	200,000	3,000	2,500				
1901	14,320	100,240	34,000	27,987				
1902	14,600	97,700	149,450	105,350			700 tons salt	1,400
1903	13,819	78,095	144,715	140,332				
1904	20,500	132,000	216,576	170,995				
1905	22,877	163,585	113,000	44,250				
1906	23,900	199,300	54,000	53,000			150 tons salt	300
1907	16,000	118,000	157,100	134,111				
1908	10,000	50,000	111,686	66,700	52,000	$12,050		
1909	4,500	105,000	132,010	67,010	47,500	5,075		
1910	22,497	99,185	112,000	74,700	100,000	10,000		
1911	19,695	87,445	173,646	108,786	328,740	36,500		
1912	18,000	88,200	5,300	3,000	260,000	31,000		
1913	16,000	70,500	428,357	198,953	60,000	9,000		
Totals	409,808	$2,514,750	1,854,799	$1,244,724	848,240	$103,625		$6,700

*Estimated.

Totals.

Brick	$2,514,750
Stone industry	1,244,724
Mineral water	103,625
Miscellaneous	6,700
Total to end of 1913	$3,869,799

Photo No. 172. Duxbury Point and Reef, Marin County, California, looking southeast. Dip of shale beds is to west (right).

Photo No. 165. Asphaltic residue from oil seepage, at base of sea-cliff, northwest from Bolinas, Marin County, California.

From Bolinas Point to Duxbury Point the shale strata, which are somewhat indurated, strike southeast and dip to the west at an angle of 45° to 50°. At the latter place the beds are massive and continue for some distance into the sea, forming the well-known and dangerous Duxbury Reef (see photo No. 172). In the cliffs at this point the asphaltum appears in thin seams cutting across and nearly normal to the dip of the strata. There are small dabs of asphaltum sticking on the washed reef throughout this section from Duxbury Point to Abalone Beach. On first thought these "dabs" might appear to be artificial (i. e. sea-drift washed from passing vessels), but observation showed them to occur only in the vicinity of the oil seepages.

At Bolinas, about $\frac{1}{3}$ of a mile west of the entrance to the Lagoon, the division between the soft, yellow sandstone to the east and the shale to the west is marked by a vertical fault plane. The dip of the sandstone is east, 10° to 15°. In this sandstone at a few feet above the beach level is a stratum of shells, 6 to 8 inches thick, distinctly marking the bedding planes.

On the mesa back of Duxbury Point (apparently an old sea terrace) two wells were drilled for oil about 1902. It is said that in the second well, which was a few yards from the sea cliff, a small flow of oil was obtained and several drumsful pumped out; that a charge of dynamite was exploded in the well to open up the flow more but that it became choked off entirely instead. Others state that the oil in the well was some of that hauled out there for fuel for the boilers.

Bibl.: R. XI, p. 249; XIII, p. 36.

BRICK AND CLAY.

At the *Bothing Home*, near Fairfax, pottery is being made on a small scale by the inmates, from clay obtained nearby.

Kaolin has been found near Duncan Mills. R. V, p. 108.

McNear Brick Company (formerly Fortin Brick Company). J. A. McNear, president, E. B. McNear, manager and superintendent. This plant is on tidewater at McNear's Point, 4 miles east of San Rafael. There is no railroad accommodation nearer than San Rafael, but the product is shipped by barges to the various bay points (see photo No. 131). Bricks were first made here about 30 years ago, and the fires in the present plant have not been out in the past 14 years. The property is part of the Spanish grant, "Rancho Santa Margarita y Las Gallinas."

The clay and shale beds which are on the northwest face of the hill are underlaid by Franciscan metamorphic sandstone. In the quarry, blasting is done by battery, and the material is loaded into cars by a small Bucyrus steam shovel (Class 14-B—on turntable like a locomotive crane). The cars are horsedrawn in trains to the storage bins.

From there the clay goes through the crushers, elevators and screens to the pug-mill. The "dry-pan process" is used. The dampened clay is mixed in the pug-mill and discharged into an auger, stiff-mud machine. From this it is forced in a slow-moving continuous stream, rectangular in cross-section and cut into proper lengths by a wire brick-cutting machine. The belt conveyor leading from the cutter travels slightly faster than the clay stream and so separates the blocks after they are cut. From there the "green" bricks are taken to the drying sheds (see photo No. 128).

Photo No. 131. Plant and furnaces of the McNear Brick Company, near San Rafael, Marin County, California.

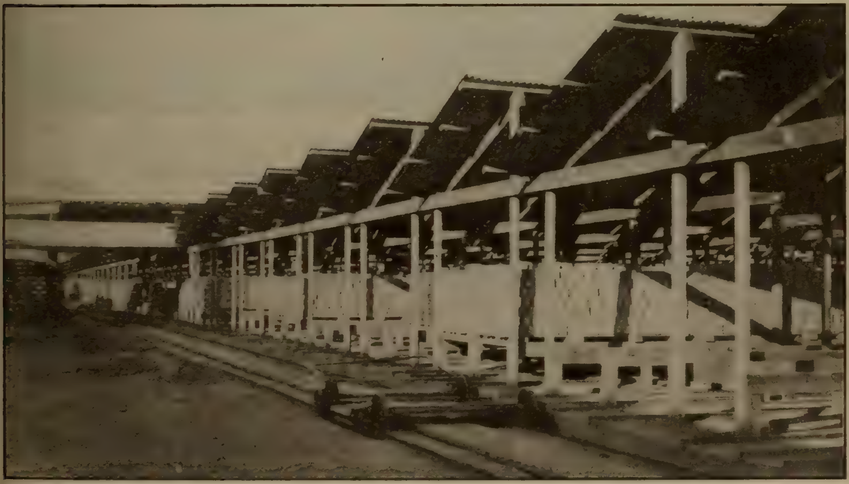


Photo No. 128. Drying sheds, McNear Brick Company, Marin County, California.

The brick forming end of the plant has a capacity considerably in excess of that of the furnaces. The excess is stored in the drying sheds during the summer months for burning in the winter when outside work is curtailed on account of the weather. The yearly capacity of the plant is 20,000,000 bricks. About ninety men are employed. There are two Hoffmann continuous kilns, coal fired (see photo No. 126 and drawing). The draft is from the top of the furnace down through the charge of bricks to the under-floor flues that carry it to the stack.

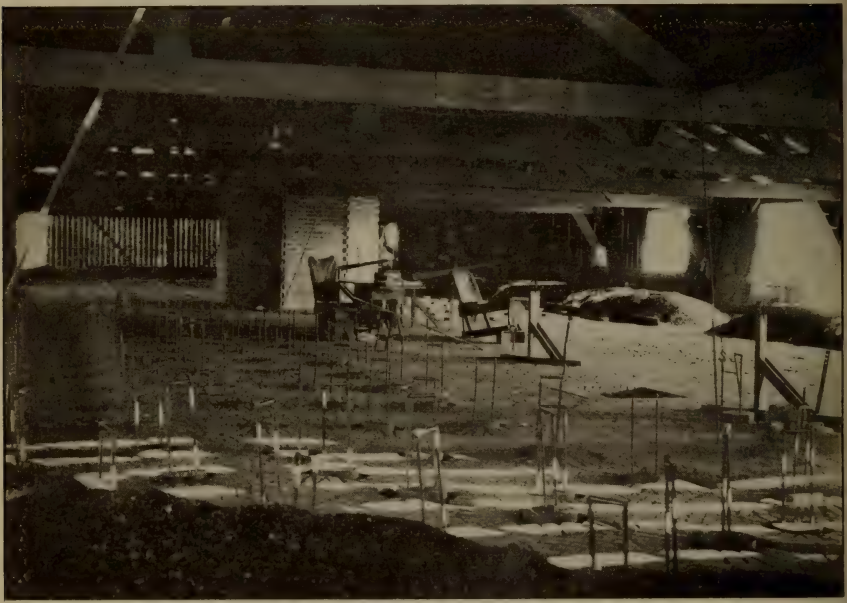
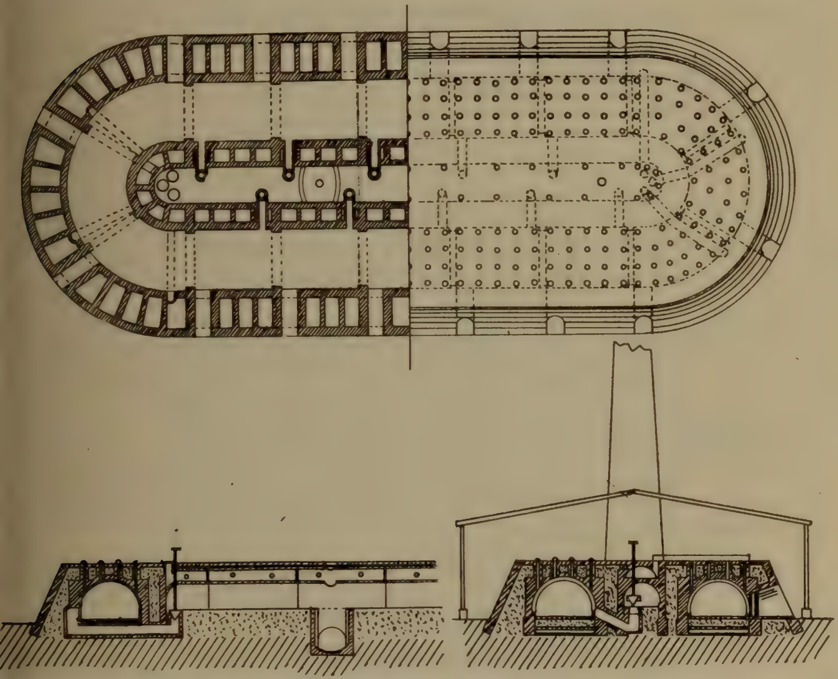


Photo No. 126. Top of Hoffmann brick kiln, McNear Brick Company, near San Rafael, Marin County, California.

The Hoffmann kiln consists of an arched, tunnel-shaped, firing chamber, either circular or oval in plan, or of two parallel tunnels joined by circular ends. The furnaces at the McNear plant are of the last-named type. This produces an endless kiln capable of being subdivided into a series of chambers of nearly equal size by means of cross partitions of a temporary character. From each chamber three flues lead respectively to: the central stack; the chamber preceding it in the series; and the chamber following it. Each of these flues may be closed at will by the insertion of a partition of sheet iron. Each compartment also has a doorway connected with the outside for charging and discharging. Slack or other fine coal is fed in at the top of the chambers (see photo No. 126) and one chamber is fired. Some plants use crude oil. The flues leading to the stack are closed except that from the newest chamber charged, behind the one fired. The interamber flues are left open except the one between the fired chamber d that behind it in the series. By this arrangement the hot gases om the fired chamber pass successively through the other charged ambers, finally passing out from the last one to the central stack. hen the bricks in the fired chamber are sufficiently burned, it is lowed to cool by closing its flues, and the next chamber ahead is red. After removing the burned bricks the compartment is recharged d its flues opened *to* the stack and *from* the chamber behind it.

Bibl.: R. VIII, p. 342; XII, p. 382; XIII, p. 615; Bull. 38, p. 249.



Hoffmann continuous brick kiln. Plan and vertical sections.

There is clay on the *Mailliard Ranch*, on Spring Creek near Lagunitas tation, about 8 miles northwest from San Rafael. The Lagunitas evelopment Company, 202 Commercial Building, San Francisco, is wner. Occurrences of chromite and manganese are also reported on he same property.

Bibl.: R. XI, p. 253; XII, pp. 329, 382; XIII, p. 506; Bull. 38, p. 362.

Patent Brick Company. Home office, 1218 Merchants' Exchange Building, San Francisco. The plant is at Gallinas Station on the Northwestern Pacific Railroad, 4 miles east of north from San Rafael. It is also on a tidal canal for barges via Gallinas Creek. The present company began operations here about 1870; but the plant has been idle the past five years on account of low prices and small demand. The increasing use of concrete has cut heavily into the demand for bricks. The company still has some stock on hand which is being disposed of inland at rail connections. It is intended to resume operations whenever prices and conditions improve.

The plant has a capacity of 1,500,000 per month, and uses the dry-pan process. There is also a pressed brick department. The equipment includes: three dry-pan grinders, pug-mill, brick machine, cutters, press, drying kilns, two Hoffmann continuous kilns (coal fired), one circular kiln (oil fired) for pressed, Roman and fancy brick. A third furnace, now old and abandoned, is said to have been the first Hoffmann brick kiln built in America. The clay deposits are on the hillsides back of the plant.

Bibl.: R. XII, p. 382; XIII, p. 615; Bull. 38, p. 250.

Remillard Brick Company. This company for many years operated a plant at Greenbrae, 2 miles south of San Rafael, but it has now been idle for some time and the machinery disposed of.

Bibl: R. VIII, p. 342; XII, p. 382; XIII, p. 615; Bull. 38, p. 250.

CHROME.

(See Mailliard Ranch, under Brick and Clay.)

COAL.

(See Escalle under Stone Industry.)

There is a specimen of lignite in the museum of the State Mining Bureau from the Overton Ranch, on Tomales Bay.

COPPER.

In 1863 two or three companies did some work on a series of copper prospects about a mile east of Woodville (then Dogtown), north of Bolinas, and a small tonnage of sorted ore was shipped for treatment.

The Bolinas Copper Mining Company, T. P. H. Whitelaw, manager, in 1900 shipped some copper ore from the same locality, but nothing has been done since.

Bibl: R. V., p. 98; XI, p. 253; XIII, p. 59; Bull. 20, p. 14; Bull. 50, p. 168.

GRANITE.

There is a specimen of granite in the museum of the State Mining ureau from Porter's Point, and the records show a production of 000 cubic feet valued at $5,000 reported in 1895.

Bibl.: Bull. 8; Bull. 38, p. 364.

GRAPHITE.

Graphite has been reported from Marin County, but the locality is ot definitely known.

Bibl.: R. IV, p. 224.

JEWELERS' MATERIALS.

Garnets in mica schist are found near California City on the Tiburon eninsula and on the Reed Ranch.

So-called *moonstones* (principally translucent quartz) are found as ebbles along the ocean beach, particularly near Bolinas Point.

Jasper is found quite plentifully in Marin County in connection with e Franciscan cherts. Dr. S. M. Augustine of San Rafael has a large d beautiful collection of polished specimens of red and yellow jasper d banded chalcedony from around San Rafael, Sausalito, and other arts of Marin County. It makes beautiful jewelry but is too expensive collect and prepare. It is highly siliceous and very hard, but is t obtainable in large enough pieces for building decoration. There an infinite variety of coloring and figures.

Bibl.: Bull. 37, pp. 52, 78; Bull. 38, p. 366.

MANGANESE.

(See Mailliard Ranch under Brick and Clay). Manganese has also een found near Tomales and Sausalito.

Bibl.: R. IV, p. 316; Bull. 38, p. 368.

MINERAL WATER.

Ancha Vista Spring. J. Richards, Sausalito, owner. Dave Davis, ssee. The spring is on the slope of Red Hill at San Anselmo, elevation 0 feet (U. S. G. S.). It has been known for over thirty years but tilized medically only the last few years. It is in sandstone. Analy-s said to be by the Medical Department, University of California, ows 21 grains per gallon, principally magnesia and lithia. The flow ordinarily about 100 gallons per day and a portion of the output is ipped in 5-gallon carboys. The hotel and cottages are on the adjoining roperty owned by Mr. Davis.

El Toro Spring is on the Taylor ranch near Novato. It is no utilized at present.

> Bibl.: R. XI, p. 251; XIII, p. 512; U. S. G. S., Water Sup Pap. 338, p. 255.

Rocky Point Hot Sulphur Springs are on the beach at Rocky Poin 8 miles southeast of Bolinas. They are not utilized except locally.

> Bibl.: R. XI, p. 250; XIII, p. 512; U. S. G. S., Water Sup Pap. 338, p. 80.

Sausalito Spring Water Company., Sausalito. This is plain wate not mineral.

Tamalpais Mineral Water Spring. Borello Bros., owner. This a drilled well at First and Hayes streets, San Rafael, elevation 50 fee (U. S. G. S.). The well was sunk in 1903, and the water analyzed i December, 1904, followed immediately by bottling operations. It i 26 feet deep, not artesian, and has no contained gas. It is bottle carbonated, and is also used in the manufacture of soda water an other flavored, soft drinks. Temperature 60° F. A 3 h.p. electr motor runs the pump and bottling machines.

> Bibl.: U. S. G. S., Water Sup. Pap. 338, p. 307.

NATURAL GAS.

An inflammable gas escapes from the reef at Duxbury Point, nea Bolinas. It can be observed only at extreme low tide. It is state that natural gas has also been found near Nicasio.

> Bibl.: R. VII, p. 184; XIII, p. 567.

PETROLEUM.

(See under Asphaltum).

SALT.

Salt was first made from the bay water by evaporation at San Rafa in 1867. More recently the Golden Gate Salt Company reported a output for a time but there has been no plant in operation since 190

> Bibl.: Bull. 24, p. 106.

STONE INDUSTRY.

Angel Island Quarry (see Fort McDowell).

Daniel Contracting Company (Bull Quarry, also McNear). Hom office, 503 Market street, San Francisco. John H. Hopps, consultin

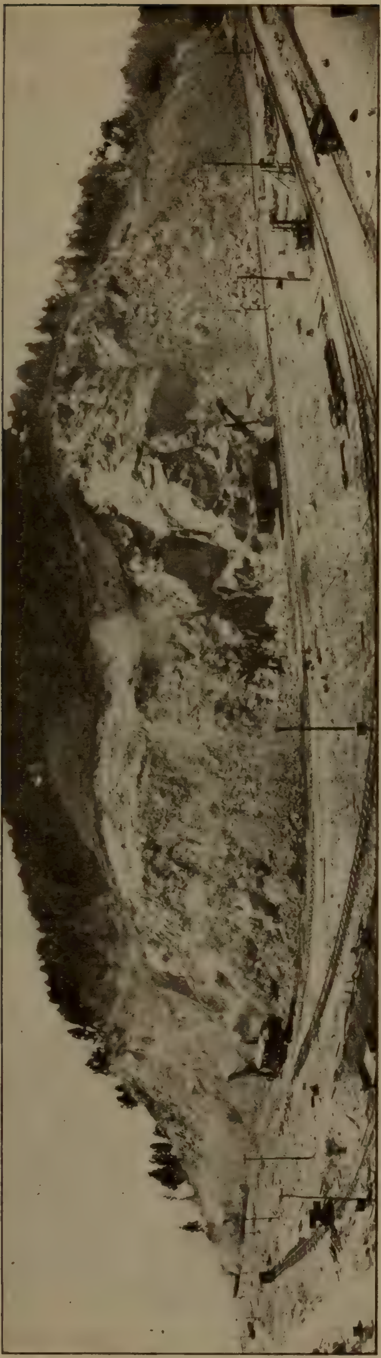


Photo No. 125B. Panoramic view of Daniel Contracting Company's quarry at San Pedro Point, six miles east of San Rafael, Marin County, California. Face 1200 feet wide.

engineer. This company is operating under lease one of the quarries on land owned by the McNear Company, Inc., at Point San Pedro, 6 miles east of San Rafael. It was known as the Bull quarry at one time, and for several years was operated by Wetmore Bros. The present operators have contracts aggregating approximately 1,000,000 tons of rubble—600,000 tons to the "Key Route" mole, Emeryville, and 400,000 tons to the San Francisco seawall. They have opened up a quarry face of 1200 feet in width (see photo No. 125B), and are shipping (June, 1914) an average of 2500 tons per day.

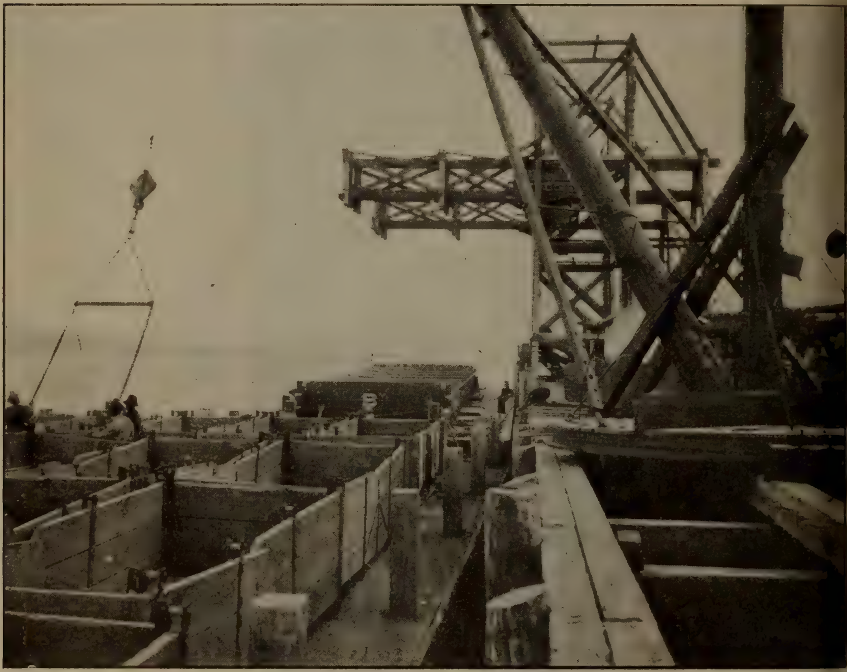


Photo No. 114. Daniel Contracting Company's loading pier and barges at San Pedro Point, Marin County, California.

In advance of the quarry face the thin skin of surface dirt was hydraulicked off. Machine drills are used and occasionally a short tunnel is driven into the face about 25 feet, branching right and left at the end. The tunnel is charged with 5 to 10 tons of dynamite wired in duplicate, and exploded with a 220-volt current. The rock is mostly a hard, bluish, Franciscan metamorphic sandstone, though in part it is yellowish brown where oxidized. The formation is massive and more or less fractured. Pieces up to 3 or 4 feet across are shipped —as large as can be handled conveniently by the steam shovel. There is a small amount of clay on some of the fractures, and there is clay and shale at the north end of the sandstone. The material is loaded the steam shovels into side-tipping dump cars and run out onto the ading pier (see photos Nos. 114 and 115) in trains by small steam comotives. There it is dumped onto a grizzly with 2½-inch openings. he coarse drops into a skip with bottom discharge in which it is ansferred to the barges alongside by an overhead traveling electric ane of seven tons capacity. The fines are elevated by two belt con-eyors (each driven by a 15-h.p. motor) to the waste bin from hich they are hauled and dumped along the shore. The company has service twelve "skip" barges (see foreground of photo No. 114),

hoto No. 115. Daniel Contracting Company's pier and quarry at San Pedro Point, Marin County, California.

ro deck barges (for large single stones), two bottom dump (note rge "B" in background of photo No. 114) and two side-dump barges. he first named hold 40 to 50 skips of four cubic yards capacity ich—a barge capacity of 200 to 300 tons. The bottom dump barges rry 900 tons each, and the side dumps about 700 tons. These last ro classes are used for subaqueous dumping, and the skips when the l has reached above the level of the water or for fills ashore.

The equipment, which has a rated capacity to ship 4000 tons per two n-hour shifts, besides that already noted, includes: three steam iovels (with two cubic yard buckets); eight "dinky" locomotives (six service); air compressor, 150 h.p., electric driven. Crude oil fuel is sed. Seventy-five to 90 men are employed. There is also a crushing id screening plant of 250 cubic yards per day (ten hours) capacity, hich is operated only intermittently.

Bibl.: Bull. 38, p. 318.

Dodge & Croker (see Short Ranch).

Escalle Quarry. Jean Escalle, owner. This is a small quarry in a ravine at Escalle Station. The rock is a blue metamorphic sandstone, broken up by streaks of black slickensided serpentine. There is also a small broken vein of coal—a shaly lignite. There is considerable overburden of soil and oxidized rock. The county at one time had a portable crushing plant here getting out road material.

Forbes Quarry. Miss Kate Forbes, San Rafael, owner. This red chert quarry is in a hill at the north edge of town and has been utilized for street and concrete work. The material is much foliated and breaks up small without requiring a crushing plant. There is also some sandstone and shale interbedded. Idle in 1913.

Bibl.: R. XII, p. 389; XIII, p. 625; Bull. 38, p. 318.

Fort Baker Quarry. U. S. Government, owner. Palmer, McBride & Quayle of San Francisco have a contract to deliver to the Exposition grounds in San Francisco 75,000 cubic yards or more (but not to exceed 120,000 cubic yards) for road building. They are equipped to handle 1500 tons per day at the quarry, but the unloading facilities at the Exposition can as yet take care of only 500 tons. A steam shovel, oil burning, is used and two small locomotives with dump car trains. The barges carry 250 to 300 cubic yards and a locomotive crane with clamshell bucket unloads them. Twenty-three men were employed (November, 1913).

The rock is taken from the hill back of the guardhouse and the barracks. It is a much altered and fractured Franciscan metamorphic sandstone, dark greenish and brown in color and fine grained. Back of the hospital there is a small quarry in red chert, which is used occasionally for road repairs around the reservation.

Fort Barry (see Point Bonita quarry).

Fort McDowell Quarry (formerly called Angel Island quarry). U. S. Government, owner; under supervision of the constructing quartermaster, U. S. Army, Fort McDowell. As the earlier name implies, this quarry is on Angel Island. It is on a rocky point on the east side of the island and was first opened up about 1890 by the engineering corps. The old crushing plant, steam driven, had a capacity of 40 tons per day. This has been displaced in 1913 by a new plant using electric power and having a capacity of 40 tons per hour. The new bunkers, with a storage capacity of 800 tons, load direct to barges.

Electric power is brought to the island by submarine cable from Sausalito. The equipment includes a No. 5 Symons gyratory crusher, bucket elevator, and a trommel. Three sizes of product are made: screenings, $\frac{3}{4}$-inch and $1\frac{1}{2}$-inch. The new plant cost $15,000, but it is estimated that it will save the government $60,000.

he rock is a blue-gray metamorphic sandstone in massive beds, with
e partly oxidized material at the surface. Up to October, 1913,
tal of 45,000 cubic yards of clean rock and 40,000 cubic yards
xidized have been produced, the latter being used on roads and fills.
s estimated that there are 150,000 cubic yards yet available for
rrying, of which 70,000 cubic yards will be used for road work.

his quarry has furnished rock for concrete and other construction
everal of the Bay posts, including Fort Mason, the Presidio and
traz Island. With sand also obtained on the island this rock was
loyed in constructing the new buildings of the enlarged recruit
ot of Fort McDowell, just above the quarry. These reenforced con-
e structures represent an expenditure of $600,000 for materials
e, as the labor, except skilled civilian foremen, was furnished entirely
military prisoners. There is a barracks building and a mess hall
a normal capacity for 2000 men each. The upper floor of the
s hall is a drill hall. There is also a guardhouse, hospital, post
ange, administration building, and quarters for both commissioned
non-commissioned staff, all of concrete.

ray Bros. (see San Francisco Quarries Company).

offman Quarry. B. H. Hoffman, owner. This is a small quarry
iles north of San Rafael, on the Petaluma road, which is used occa-
ally for road work nearby. Idle in 1913.

Bibl.: Bull. 38, p. 319.

otaling Quarry. Hotaling Estate Company, owners, Merchants'
hange Building, San Francisco. Steffini-Bartini Company at one
e worked it under lease. It is at the south end of Clark street,
Rafael, and is operated intermittently on a royalty basis of $1 per
(about 2 cubic yards). The rock, which is a blue metamorphic
dstone, is used for curbings and rubble walls. The Presbyterian
rch in San Rafael is built with rubble from this quarry. Produc-
to date has been about 10,000 cubic yards. There is no plant.

Bibl.: R. XII, p. 389; XIII, p. 625; Bull. 38, p. 319.

ordan Quarry (see San Francisco Quarries Company).

arin Rock Company. S. Brizzolara, president, 119 Jackson street,
Francisco; C. A. Macomber, superintendent, San Anselmo. This
rry is on the west edge of San Anselmo, at an elevation of 100 feet
S. G. S.). Work began in 1909. The rock is a metamorphic sand-
ne, in parts serpentinized. There are also streaks of a soft black
gouge, slickensided. The hardest and cleanest of the rock is used
rubble. A derrick raises the rock in skips to the crusher. A 30
motor runs the compressor, and a 7½ h.p. the hoist. There are

two other motors for the crushing and screening machinery, 10 an 5 h.p. A gasoline engine was formerly used. The coarser breakin is done with a jaw crusher, and the finer by a Gates "D" gyrator The revolving screens make four sizes of product. The company als has a Springfield traction road roller for street work. Twelve or fiftee men are required when in full operation (50 tons per day capacity) The waste is used for fills about town.

McNear Quarries (see Daniel Contracting Company and San Fran cisco Quarries Company).

J. Martin Miller has 5 acres near Schuetzen Park Station, containin rock suitable for road work. Only small amounts have been used s far as there is no regular quarry opened up.

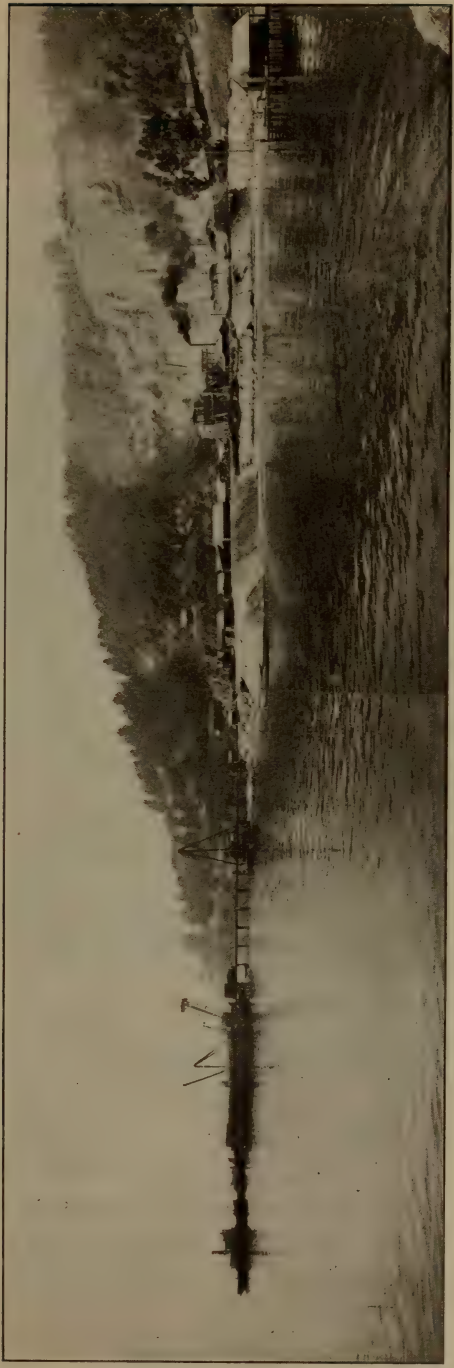
The Mount Tamalpais Cemetery Quarry is in the cemetery northeas of San Rafael. The rock is metamorphic sandstone and has bee employed for curbings and other uses about the grounds. It is worke only intermittently.

Bibl.: R. XII, p. 389; Bull. 38, p. 319.

Northwestern Pacific Railroad Company. General offices, Phela Building, San Francisco. In extending and regrading its ferry an train terminal at Sausalito this company is completing (May, 1914) fill of 50,000 cubic yards. The rock has been taken from land owne by the Roys Estate at Roys, above Manor Station. It is mostly a bl metamorphic sandstone, with some oxidized material. The compan also has quarries at Black Point, Tiburon Point, and at Waldo, use intermittently for ballast and fills. The material from these cuts decomposed and much fractured.

Bibl.: Bull. 38, p. 319.

Point Bonita Quarry (Fort Barry). U. S. Government, owne under Engineer Corps, No. 414 Custom House, San Francisco. Th quarry is on the sea cliff within the Fort Barry reservation, just insid of the Golden Gate; elevation 50 to 100 feet (U. S. G. S.). The quarr was opened up in 1900 to provide rock for concrete work in the forti cations. Since the first large job it has been worked only occasionall The plant of 80 tons daily capacity is equipped with a No. 5 Gat gyratory crusher, 60 h.p. steam boiler (coal fired), 40 h.p. uprig engine for hoist, 25 h.p. Westinghouse "Junior" engine, wire scree (for two sizes), and bucket elevator. The rock is a metamorphic san stone with occasional fine limestone streaks. At two or three oth points on the reservation there are small cuts in red Franciscan che utilized for road material.



Panoramic photo. Quarry and pier of San Francisco Quarries Company at San Pedro Point, Marin County, California.

Raymond Land Company (see Short Ranch).

San Francisco Quarries Company (one time called Jordan Quarry, also San Francisco Bay Improvement Company). Anson Blake, president; L. A. Wittenmyer, secretary; S. H. Whitney, superintendent. Home office, Balboa Building, San Francisco. This is one of the three McNear quarries at San Pedro Point, 6 miles east of San Rafael.

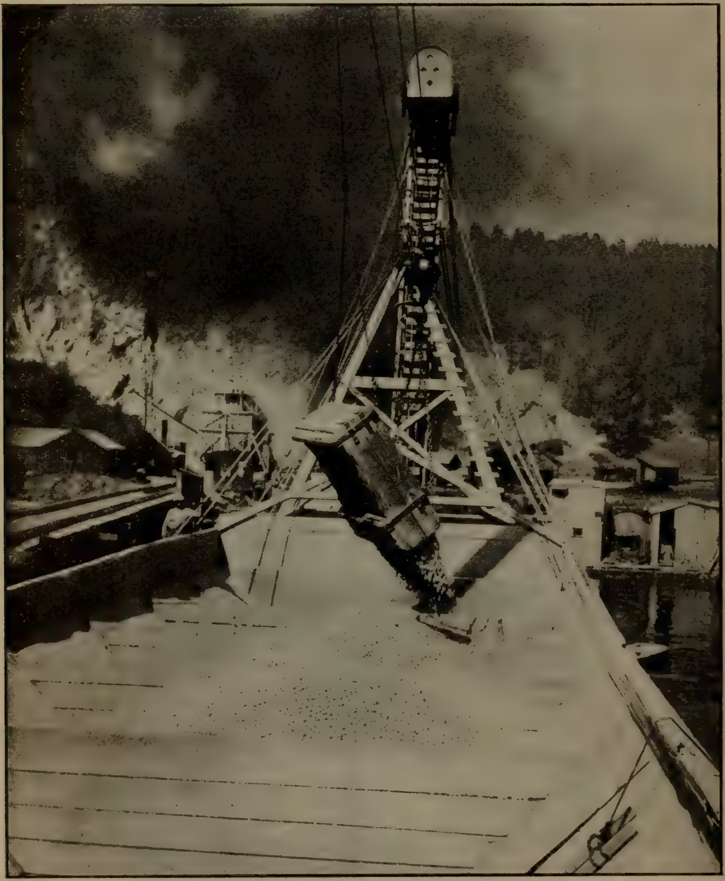


Photo No. 120. Barge "San Pablo" (self-dumping) of San Francisco Quarries Company at pier, Marin County, California. Showing bin arrangement.

Beginning January, 1914, this company also has a lease on the third quarry which is between its present working face and the McNear Brick Company plant. This third quarry was at one time operated by Gray Bros. and later by the Western Development Syndicate, but has been idle for several years.

The San Francisco Company's main quarry was opened up originally in 1876 by Dennis Jordan, and this company has been operating it the past ten years. The quarry is credited with a total output to date of about 3,000,000 cubic yards. "Sling" rock (large single pieces), rubble, and crushed rock are supplied. It is on the bay shore (see panoramic photo). The rock is hauled in skips on cars to the wharf and oaded onto the barges by a derrick.

The rock is a massive, hard, blue-gray metamorphic sandstone, and a fine face of up to 200 feet high (see photo No. 122) and about 500 feet wide is now exposed. There are occasional small lime and quartz seams. Steam operated machine drills are used. There are four derricks, with steam hoists, burning coal. The crushing plant, with a capacity of 700 tons per day, uses electric power. In addition, 300 tons of rubble per day can be handled, making a total daily capacity for the quarry of 1000 tons, with about 100 men employed. The output varies with the market demands. Crushed rock is delivered in San Francisco at $1.20 per cubic yard, or it is sold at the quarry pier at 90 cents to $1. These prices are for large tonnages.

Photo No. 121. Barge "San Pablo" of San Francisco Quarries Company, at pier. Side view.

The company has six barges with capacities of 400 to 600 tons each. The 600-ton barge (see photos No. 120 and No. 121) is self-discharging and carries a crew of five men. In the hold there is a dynamo run by a 50 h.p. gasoline engine. This furnishes power for the motor driving the conveyer belt under the pockets and the motor at the head of the bucket elevator. The bucket elevator can be raised and lowered and swung sideways on an arc so as to vary the point and height of discharge as required. It is stated that this barge cost $40,000 to build and equip. From 4 to 5 hours are required to load 500 cubic yards into it by derrick, but at the San Pablo quarry (Contra Costa County) of the same company, the same amount is loaded by two conveyer belts in 1½ hours.

Bibl.: Bull. 38, p. 319.

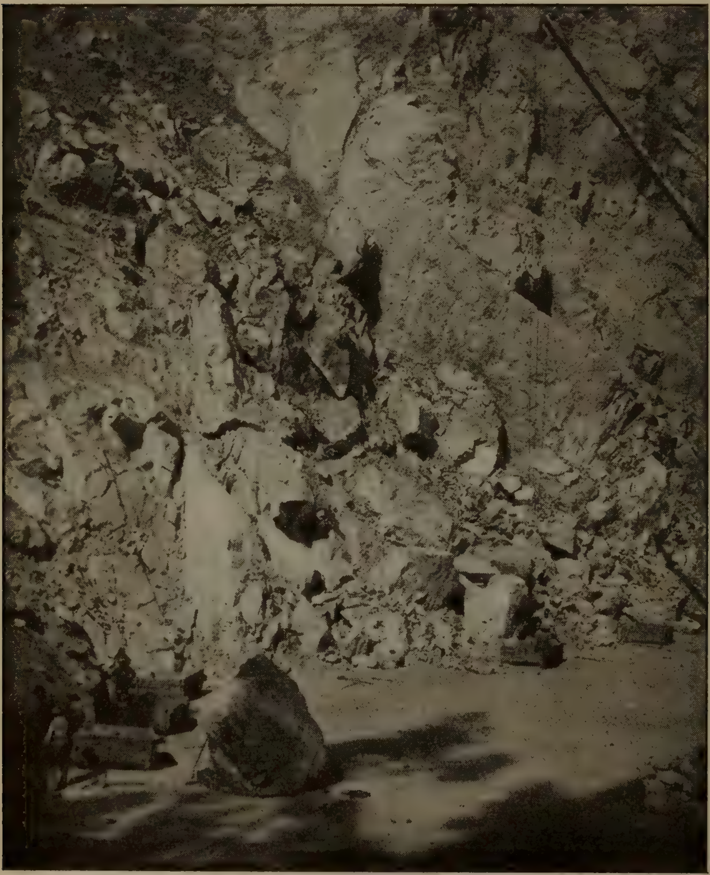


Photo No. 122. Two hundred-foot high quarry face of San Francisco Quarries Company, Marin County, California.

The San Rafael Development Company has a quarry of red rock at the end of Mission street (Pine Hill), San Rafael, but it has not been operated recently.

Short Ranch Quarries. Dodge & Croker, San Anselmo, and the Raymond Land Company, 1048 Mills Building, San Francisco, each has a small quarry on land formerly a part of the Short ranch, 1 mile north from San Anselmo. They are both operated intermittently, and the product is used for curbs and rubble walls, being sold at $2 to $5 er load (about 2 cubic yards). The rock is a blue metamorphic sandtone.

Steffini-Bartini Company (see Hotaling).

Tiburon Point Quarry (see Northwestern Pacific Railroad Company).

Western Development Syndicate (see San Francisco Quarries Company).

Wetmore Bros. (see Daniel Contracting Company).

NAPA COUNTY.

Field Work in September, 1913.

Napa County, with a land area of 783 square miles, is about 50 miles north and south, by 26 miles in width. It runs nearly to a point at both extremities, its southern end touching San Francisco Bay. It is bounded on the east by Yolo and Solano counties and on the west by Lake and Sonoma counties. The main drainage system of the county is that of the Napa Valley; in addition to which, Putah Creek flows across the northeast corner, southeasterly to the Sacramento River. Mt. St. Helena is in the northwest corner, at the junction with Lake and Sonoma counties. The principal mineral resources include quicksilver, cement, mineral water, stone industry and magnesite; with infusorial earth, limestone, copper, iron, chromite, gold, silver, and mineral paint also occurring, but of minor importance (at least in their present lack of development).

The available published records show for Napa County, to the end of 1913, a total value of quicksilver produced of practically $15,000,000, and of mineral water nearly $2,000,000. That these values are below the actual output is known, as there are no segregated figures for mineral water previous to 1894; and also as the product of some of the quicksilver mines was included in the earlier reports of the state's production, under ''various mines.'' In fact, the Knoxville mines alone are said to have produced $17,000,000 in quicksilver, while Oat Hill is credited with another $5,000,000, to say nothing of the Aetna and others. There being but the one cement plant in the county, the value of the cement output is included under ''unapportioned,'' it being the policy of the Bureau not to make private business public. Magnesite production in Napa County began at the Chiles Valley mines in 1891; but the figures for 1892 and 1893 were not segregated, being combined with those of Alameda County. The value of the materials included under ''stone industry'' is showing a healthy, steady advance. Mineral water shows considerable fluctuation, but continues an important factor.

CEMENT.

Standard Portland Cement Corporation. The manufacture of cement in Napa County began with the operation of this company's plant on March 17, 1903, since when it has been a continuous, steady producer. The capacity has been doubled from its initial figure, being now 2500 barrels of cement daily. Geo. F. Cameron is president, L. F. Young, secretary, with A. G. Lang superintendent at the plant; home office, Crocker Building, San Francisco. The plant is in Sec. 19, T. 4 N., R. 3 W., ½ mile from Napa Junction station of the Southern

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NAPA COUNTY—Table of Mineral Production.

Year	Quicksilver		Mineral water		Magnesite		Stone industry. Value	Limestone		Miscellaneous and unapportioned	
	Flasks	Value	Gallons	Value	Tons	Value		Tons	Value	Kind	Value
Manhattan Mine output 1863 to 1876	3,594	$235,876	*	*							
1862	444	16,139									
1863	852	35,852									
1864	2,714	124,573									
1865	3,545	162,716									
1866	2,254	119,755									
1867	7,862	360,866									
1868	9,808	450,187									
1869	6,598	302,848									
1870	5,766	330,853									
1871	4,098	258,584									
1872	4,876	321,475									
1873	5,266	423,018									
1874	11,705	1,231,132								Gold and silver	$93,000
1875	9,453	795,470									
1876	11,303	497,332									
1877	13,127	489,637									
1878	10,810	355,649									
1879	9,446	281,961									
1880	6,830	211,730									
1881	7,746	231,063									
1882	9,013	254,467									
1883	7,784	223,790									
1884	5,188	158,234									
1885	3,891	119,648								Gold and silver	$5,000
1886	5,656	200,788								Gold and silver	16,000
1887	6,247	264,717								Gold and silver	22,500
1888	5,150	218,875								Gold and silver	50,000
1889	5,402	243,090								Gold and silver	95,000
1890	3,934	206,535								Gold and silver	57,046
1891	4,896	221,544			1,500	$6,000				Gold and silver	30,517
1892	8,612	350,595								Gold and silver	23,689
										Total gold and silver	$392,752
1893	11,505	422,809									
1894	9,705	298,016	97,275	$41,231	1,440	10,240				51 tons infusorial earth	$2,040
1895	9,318	372,500	199,397	99,700	2,200	17,000					
1896	11,411	403,031	218,680	81,335	1,500	11,000					
1897	12,281	459,753	159,896	81,948	1,143	13,671					
1898	12,368	472,972	169,261	63,919	1,263	19,075					
1899	11,696	598,322	171,567	85,964	1,180	17,130					
1900	8,724	403,500	171,000	72,200	1,983	17,400					
1901	7,798	388,176	158,830	109,900	700	11,622		8,919	$6,690		
1902	7,142	304,474	236,229	97,048	150	450	$500	7,086	8,496		
1903	7,859	333,006	244,400	124,000	61	915	3,375			290,368 barrels cement	435,552
1904	†5,328	199,586	386,000	104,750	12	78	4,019				
1905	4,853	171,910	279,400	89,500			500				
1906	2,380	86,870	84,000	90,500			2,777				
1907	2,500	95,400	240,000	103,600			3,000				
1908	2,340	98,912	145,500	101,090			78,728				
1909	1,625	80,535	123,072	96,279			138,636			Unapportioned, 1900 to 1909, inclusive	3,151,182
1910	646	29,231	152,772	92,960			122,219			Unapportioned, 1910 to 1913, inclusive	2,893,786
1911	140	6,441	141,540	86,530			127,428				
1912	287	12,065	136,750	81,997	55	550	172,646				
1913	287	11,546	151,520	75,548			243,759			Sandstone	8,000
Totals	334,063	$14,948,054	3,667,089	$1,779,999	13,187	$125,131	$897,587	16,005	$15,186		$6,883,312

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*Napa Soda Springs have been bottling water for sale since 1860; but no segregated figures available for Napa County previous to 1894.
†Flasks of 76½ pounds to June, 1904, of 75 pounds since.

Totals.

Quicksilver	$14,948,054
Mineral water	1,779,999
Magnesite	124,581
Stone industry	897,587
Limestone	15,186
Miscellaneous and unapportioned	6,883,312
Total to end of 1913	$24,648,719

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Pacific Railroad, with which it is connected by spur tracks direct to the mill. Tidewater is only 1½ miles distant, but not utilized as yet. The same company also has a 12,000-barrel per day plant at Davenport in Santa Cruz County.

For the benefit of those who may not be familiar with the process of making ''Portland'' cement, a short description is here given:

*''By a Portland cement is meant the product obtained from the heating or calcining up to incipient fusion of intimate mixtures, either natural or artificial, of argillaceous with calcareous substances, the calcined product to contain at least 1.7 times as much of lime, by weight, as of the materials which give the lime its hydraulic properties, and to be finely pulverized after said calcination, and thereafter additions or substitutions for the purpose only of regulating certain properties of technical importance to be allowable to not exceeding 2 per cent of the calcined product.''

Photo No. 44. Clay pit of the Standard Portland Cement Company, Napa Junction, Napa County.

This definition lacks the requirement of pulverizing or artificial mixing of the materials prior to burning; and thus permits the inclusion of some ''natural Portlands'' under the specifications.

The ideal Portland cement would consist essentially of lime and silica in the proportions of 73.6 per cent and 26.4 per cent respectively (tricalcic silicate, $3CaO, SiO_2$), but as such a material can not be clinkered, except in the oxyhydrogen blowpipe or the electric furnace, it is

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*Professional Paper No. 28, Corps of Engineers, U. S. A., p. 30.

impossible to produce it commercially at the present time. For this reason it is necessary in actual practice to have other ingredients present to act as a flux and thus lower the temperature of fusion, permitting the combination of the lime and the silica. Alumina (Al_2O_3) and iron oxide (Fe_2O_3) fill this role. The raw mixture, before burning, is made up approximately as follows: 75 per cent lime carbonate ($CaCO_3$); 20 per cent silica, alumina and iron oxide together; 5 per cent impurities, including magnesia, sulphur and alkalies, some of which are always present. These materials, after being dried, are ground fine, the grinding accomplishing also the additional purpose of thoroughly mixing the constituents. Then they are heated to the point of incipient fusion (2500°–3500° F. in the hottest zone), thus forming "clinker"—a bluish black in color, and more or less porous in appearance. The clinker, in turn, is finely ground (up to 2 per cent of gypsum being added to retard setting), so that 90 per cent to 95 per cent will pass 100-mesh screen, and 75 per cent to 85 per cent through 200-mesh. This almost impalpable powder is the Portland cement of commerce, named "Portland" originally, not from the locality where it was made, but from its resemblance after setting to the oolitic limestone found at Portland, England.

Photo No. 46. Steam shovel in limestone quarry of Standard Portland Cement Company, Napa Junction, Napa County.

Eckel (''Cements, Limes and Plasters,'' 1905, p. 494) says that normally a 60-foot kiln, working on a dry mixture will produce from 140 to 180 barrels of cement per day of twenty-four hours. Of coal as kiln fuel, 120 to 140 pounds are required per barrel of cement. One gallon of crude oil is equivalent to 10 pounds of coal, or 11 to 14 gallons of oil are required per barrel of cement. The capacity of a given kiln is lower with oil than with coal. Oil is used principally in California and Colorado. Of natural gas, 20,000 cubic feet are required as the equivalent of one ton of coal. Gas is used principally in Kansas and Ohio. For kiln linings, bricks of the following materials are used: Cement clinker, alumina, magnesia (calcined magnesite) and bauxite. The power and machinery required for grinding the clinker are about the same as for the raw materials; for, though the tonnage to be handled is only about two thirds, the material is much harder.

Photo No. 47. Rotary driers in mill of Standard Portland Cement Company, Napa Junction, Napa County.

At the plant of the Pacific Portland Cement Corporation limestone and clay are obtained from pits close by the mill, though at present, owing to a decrease in the lime content, a portion of high grade lime rock from near Santa Cruz is added, to ''sweeten'' the charge, before passing through the drier. In the quarry the clay is loaded by hand, and the limestone by a Marion steam-shovel (1½ cubic yards dipper), oil-fired (photos Nos. 44 and 46). The cars are drawn to the foot of the mill incline by cables and by a small steam locomotive. After passing through the gyratory crushers (one No. 9, three No. 5, Allis-Chalmers), the material goes to bins from which the rotary driers are fed. There are two rotary driers, oil-fired, 6′ x 40′, set on a grade of $\frac{3}{4}$ inch per foot, and running at 3$\frac{1}{2}$ r.p.m. (photo No. 47). A steel "drag conveyer" takes the dried product to the ball mill bins. The excess over the ball mill feed, on day shift, goes to storage bins for the night shift feed, as the quarries are not worked at night. There are thirteen ball mills, running 24 r.p.m., divided between the raw crushing and the clinker ends of the process. After the ball mills, the mixture is further ground in tube mills (seventeen in entire plant, each 5′ x 22′, running 24 r.p.m.) and then passes to the rotary kilns, where it is clinkered.

Photo No. 49. Rotary kilns in mill of Standard Portland Cement Company, Napa Junction, Napa County.

Samples are taken of the raw material after the drier, and again at the end of the ball mills. The finished product is sampled after the tube mills. This plant has two rotary kilns (photo No. 49), 7′ 6″ diameter x 125′ long, and ten, 6′ diameter x 60′ long. The larger ones are run at $\frac{1}{2}$ r.p.m. and the others at 1 revolution per 1$\frac{1}{4}$ minutes. All are set at a grade of $\frac{3}{4}$ inch per foot. The capacity of the two large kilns is about 1000 barrels per day, while that of the ten small ones is about 1500 to 1600 barrels. They all use crude oil for fuel. As the clinker falls from the kiln it is sprayed with water, partly to

ool it but principally to break it up, and then elevated to the cool-
g tower (seen in the right edge of the photograph). The cooling
owers have baffle plates to check the fall, and have air circulation.
he desirable average size of the clinker is about that of a hickory
ut. The higher the percentage of lime, the smaller is the clinker;
hile with a lower lime content, the mixture has a tendency to fuse
ore and form larger masses. The lime content is kept at about 74.5
er cent $CaCO_3$ before entering the kilns, the balance being clay. Gyp-
um is added to the clinker as it goes to the ball mills, and is repre-
nted by 1.75 per cent SO_3 in the finished product. As the California

Photo No. 51. Final tube mills in mill of Standard Portland Cement Company, Napa Junction, Napa County.

lants all burn oil, it is not necessary to take into account the addition
f fuel ash, as in the eastern plants using powdered coal. It is advisa-
le to carry alumina as low as possible, to give the cement a slower set
nd greater ultimate strength.

As there are times during inclement weather when the quarries can
ot be worked, the raw end of the plant has a capacity somewhat in
xcess of the finishing, and the surplus clinker is stored. Belt con-
eyers are used both to and from this storage pile. The next step is
rinding the clinker, a repetition of that preceding the burning—first
ball mills and finishing in tube mills (photo No. 51). From the
ischarge end of the tube mill, the finely ground powder is drawn by a
uction blower through a tube to the storage bins. The storage bins

have a capacity of 125,000 barrels of cement. Here it is sacked (95 pounds each) using a mechanical filling device and loaded directly into the freight cars. Electric power is used throughout the mill, and belt and other mechanical conveyers wherever possible. About 3500 h.p. is consumed, there being two 800 h.p. motors besides a large number of smaller ones. The tubemills are all of the trunnion type. The company has 200 men at work, with a monthly payroll of $16,000 to $18,000. The mill is operated continuously throughout the twenty-four hours. Twenty-five thousand gallons of water are used per day.

As the geology of the deposit is described in Bulletin 38 (pages 180–182), it will only be summarized here. The limestone occurs in beds, 1 to 4 feet thick, which dip to the north at 40°. It is fossiliferous and party crystalline, and is overlaid by a yellow, calcareous clay. "The clay at the east end of the quarry is very calcareous, but at the extreme west end it is more argillaceous. Overlaying all is a dark brown adobe." About ⅓ mile south of the main pit, the company is opening a new quarry in a low, rounded hill, exposing beds of crystalline limestone mixed with some clay. Photo No. 54 is a general view of the plant from the southeast. It shows the clinker storage pile on the right, and part of the clay pit in the foreground.

Photo No. 54. Standard Portland Cement Company, general view of plant from southeast.

Bibl.: Bull. 38, pp. 178-182; U. S. G. S., Bull. 243, p. 121; Bull. 522, p. 121; Min. Res. 1912, Pt. II, p. 518; CEMENTS, LIMES AND PLASTERS, E. C. Eckel, 1905.

CHROMITE.

There are undeveloped deposits of chromite, east of Napa, in Pope and Chiles valleys and near St. Helena.

Bibl.: R. IV, p. 136; V, p. 102; VI, Pt. I, p. 100; XIII, p. 49; Bull. 38, p. 363.

COAL.

It is reported that coal was struck at a depth of 30 feet, in digging a well on the ranch of H. P. Wallace, in Pope Valley.

COPPER.

There are a number of copper prospects in Napa County, but nothing of consequence has as yet been developed. The following locations may be named:

Napa Copper Company, 5 miles north of Calistoga, on Mount St. Helena, in Sec. 17, T. 10 N., R. 5 W.; T. A. Taylor, secretary, St. Helena.

Search group, 4 miles west of Yountville, in Sec. 5, T. 6 N., R. 5 W. E. F. Rossan, Glen Ellen, owner.

There are specimens of copper ore in the Mining Bureau museum from near Monticello by Koethen and More.

Juniper group, Manhattan (Knoxville), by F. K. McAllister; and *White Rock group,* Manhattan, by Thos. A. Finnell.

Bibl.: Bull. 50, p. 165.

GOLD AND SILVER.

Brown and Smith Consolidated (*Mountain View,* also *Red Cloud*). This claim was located about twenty years ago, in Kings Canyon, near the Palisade mine, 3 miles north of Calistoga. They found nothing of value.

Bibl.: R. XIII, p. 234.

Calistoga Mine (see *Silverado*).

P. Flynn claims to have found a vein carrying gold values, on his ranch on the Oat Hill road north of Calistoga, in Sec. 30, T. 9 N., R. 6 W.

Griffith Prospect, on Alta Peak, 17 miles northeast of Napa. Some development work was done in 1895, but no values found.

Bibl.: R. XIII, p. 234.

Grigsby Mine (see *Palisade*).

Manuel Prospect. This prospect is located on patented (Mexican grant) land, 1 mile east of Calistoga, elevation 650 feet (bar.), and owned by Mrs. A. F. Mason. There is a quartz vein, showing about 300 feet of outcrop, striking northerly across a small ridge, and dipping east at about 50°. A crosscut adit has been run in about 200 feet, at a depth of 100 feet below the outcrop, and shows a quartz stringer in the face said to carry values in gold; but the main vein has not yet been cut. A lease has recently been given, under which development work will be done.

Palisade Mine. This silver mine (locally called "*Grigsby*") is in Sec. 24, T. 9 N., R. 7 W., 3½ miles northeast of Calistoga, elevation 625 feet (bar.). It was opened up in 1876 and the mill ran from 1888 to the spring of 1893. The two principal claims, Old Discovery and Ida Easley, are patented. R. F. Grigsby is the owner and still lives on the property, having a small ranch there also. The vein mineral is quartz carrying antimonial silver sulphide. A depth of 250 feet has been reached on the vein, and opened up by drifts for 1400 feet. It is situated on a north-south spur off the ridge which runs southeasterly from Mount St. Helena. The mill is equipped with 10 stamps (dry crushing), a 7-ton pulverizer, White revolving roaster, and amalgamation pans (four) and settlers (two) (Washoe process.) It is stated that 90 per cent extraction was obtained. In the four years during which the mill was operated, Grigsby states that he shipped 7,000 to 10,000 ounces of bullion per month. The average assay value of the ore was $24.50 per ton ($1 of which was in gold). The last ore treated assayed $35, but with silver down to 60 cents per ounce, it was not profitable. The water system (including water rights) was installed at a cost of $10,000. There are two pipe lines, each 3 miles in length, supplied by springs. This is at present in part utilized for running a small dynamo for lighting the buildings about the place.

Bibl.: R. V, p. 93; VI, Pt. I, p. 77; VIII, pp. 413–415; X, p. 363; XII, p. 376; XIII, p. 606; U. S. G. S. Mon. XIII, p. 370.

Silverado Mine (*Calistoga*). This mine, which is on the southeastern slope of Mount St. Helena at an elevation of about 2400 feet, in Sec. 2, T. 9 N., R. 7 W., 5 miles north from Calistoga, is owned by Harry Patten, Calistoga, R. F. D. The mine was opened up in 1872, and the 10-stamp mill operated four months in the latter part of 1874, being credited with a production of $93,000 from 2300 tons of ore. The vein which strikes about north with dip 73° W., is from 6 to 12 feet wide and carries silver sulphide with some values in gold. The ore at present exposed in the mine is stated to average $14 to $15 per ton in silver. In 1902, there were 34 tons of sorted ore shipped to the Selby smelter; and the same year, 1000 tons of ore from one of the old dumps were shipped to the smelter of the Copper King Smelting Company, on Suisun Bay, for use as flux, on account of its quartz. This ore assayed $1.10 per ton in gold and $2.65 in silver. The owner reports a lease under consideration.

Bibl.: R. VI, Pt. I, p. 77; X, p. 363; XII, p. 376; XIII, p. 606; MIN. RES. W. OF ROCKY MTS., 1874, pp. 63-65; 1875, p. 178; U. S. G. S. Mon. XIII, p. 370.

It is stated that on the east side of Conn Creek, placer gold "prospects" have been found, consisting of flour gold, and pear seed sized nuggets; but no ledge has ever been located there.

INFUSORIAL EARTH.

There is a deposit of infusorial earth on the ranch of Mrs. Kettlewell in Friends Valley west of Calistoga. It is not utilized. Also, there is a specimen of this mineral in the Mining Bureau museum, by R. E. Wood, from a small, undeveloped deposit 4 miles southeast of St. Helena.

IRON.

There are undeveloped deposits of iron ores at the head of Sulphur Creek, and in Conn Valley, also west of St. Helena. There is a specimen of hematite in the Mining Bureau museum from the "Stirling Iron Mine," by Dr. J. W. Hood of St. Helena.

Bibl.: R. II, p. 200; IV, pp. 229, 242, 258; XII, p. 327; XIII, p. 504; Bull. 38, p. 365.

LIME AND LIMESTONE.

In Pope Valley there were at one time two kilns in operation, but they have been idle for several years.

Bibl.: R. XIII, p. 629.

MAGNESITE.

The first commercial production of magnesite in California was from the deposits near Livermore, in 1886 (see U. S. G. S. Min. Res. 1886, p. 696), followed by shipments in 1891 from the Snowflake mine in Napa County. As will be noted by reference to the Table of Mineral Production, the industry in this county was active for about ten years, and then dropped off very abruptly. With the exception of a small tonnage from the Pope Valley deposit in 1912, these properties have been idle for the past ten years. The main drawback to the development and exploitation of these deposits is the lack of transportation. They are variously situated from 10 to 16 miles from Rutherford, their railroad shipping point.

The industrial uses for magnesite are many and varied, and the demand will no doubt increase materially in the next few years, particularly after the Panama Canal gives the California product a cheaper entry into the eastern markets. For most purposes magnesite is calcined before using. The largest tonnage at the present time is used in the manufacture of bricks for the lining of basic Bessemer converters both in steel and copper smelters. It is also employed in copper reverberatories and other special metallurgical furnaces such as for handling bullion; silver slimes; electric smelting; heating, welding and melting furnaces; calcium carbide kilns; and in the burning zone of rotary kilns in Portland cement plants. Wide variations of temperature, exposure, while hot, to currents of cold air or to contact with water or oil, will cause magnesia bricks to shatter and spall; so that the best results are obtained in furnaces where continuous heats are used. Not as high a purity of material is necessary in furnace liners, particularly for steel, as in some other uses; for in the case of basic open hearth steel furnaces, while the magnesite must be free (or at least very low) from silica, it can carry a noticeable percentage of iron oxide or serpentine without impairing its efficiency. In fact, by some it is considered an advantage, as such impurities permit the sintering of brick at a lower temperature than is possible with pure magnesite. ''Dead-burned'' magnesite—that from which *all* the CO_2 has been driven off—is hard to handle, having little or no plasticity. Its plasticity is said to be improved by adding partly calcined or caustic magnesite; also, heavy pressure will bind it sufficiently to allow the material to be sintered. As magnesia can be melted in an electric furnace, it would seem that it ought to be profitable to sinter such products in an electric furnace where electric power is as cheap as in California.

Another extensive and expanding field for the employment of magnesite is in the manufacture of artificial stone, flooring, tiles, wainscoting, etc. These products are put on the market under various trade names, among which may be mentioned: idealite, marbleoid, karbolith, monolith, American art marble, chemolith, artolith, asbestone, etc. The magnesite floors being put in steel railroad coaches for the Pennsylvania Railroad Company in the east, and the Southern Pacific Company in California, are by the Monolith Company of Milwaukee, Wis.; and those for the Pullman Company are by the Carbolith Company of Boston, Mass. The reaction made use of is that a moistened mixture of MgO and $MgCl_2$ will form a strong cement (known as oxchloride or Sorel cement); but there should be an absence of lime, as calcium chloride is hygroscopic and on hydrating swells, destroying the usefulness of the material. ''In using the cement for flooring, wainscoting, etc., it is mixed with sawdust or sand and coloring matter to give it the desired tint. It may be laid in a continuous sheet over considerable areas and is said to crack much less easily than Portland cement. The use of sawdust makes the material very much lighter in weight than cement, less hard, and more resilient'' (U. S. G. S. Bull. 355, p. 13). Soluble silicates of the nature of water glass are also used. A similar magnesia cement is used as a paint, but, of course, applied thinner. Such a "magnesite paint" was used as a finishing coat on the concrete building of the First National Bank at Healdsburg (see photo No. 153). "Porcelith" and "liquid stone" are two brands prepared by San Francisco firms from California magnesite. The former has been used on a number of buildings in San Francisco, notably the Hotel Shasta at Kearny and Bush streets. It is applied with a brush. The manufacturers state that "in using porcelith on brick or concrete walls, a gallon will cover about 70 square feet (two coats), and for cement plaster or smooth surfaced concrete walls from 110 to 120 square feet to the gallon according to the porosity of the walls." For use on wood it may be mixed thinner and sprayed on. For wood, it acts as a fire retardant.

Photo No. 153. First National Bank Building, Healdsburg, California. A concrete building finished with a magnesite paint.

In paper manufacture, in the "sulphite" process, a milk of lime and magnesia (calcined magnesite) is used as a carrier for SO_2, the gas being held in the mixture under pressure and thus introduced into the digester. The sulphurous gas digests the wood, leaving the fiber which is washed and used in making newspaper stock, wrapping paper, and the poorer grades of other printing and writing papers. The uses of the carbonic acid gas derived from calcinging magnesite are well known: carbonating beverages, refrigeration, etc. For these purposes it is liquefied by compression, to facilitate its transportation. CO_2 from magnesite is also used in borax refining. At the present time, however, as lime rock is obtained more cheaply, no magnesite is being used on the Pacific Coast for the manufacture of carbonic acid gas. Magnesite is used, mixed with asbestos, in boiler and steam pipe coverings. For these purposes the dolomitic varieties (containing lime) are serviceable, as they are lighter in weight. When magnesite is burned at a light red heat, the resulting magnesia has a low specific gravity (3.0), possesses sufficient plasticity to be molded into shapes, and will gradually absorb water and CO_2 from the air, similar to quicklime. If, however, the calcination is at a higher temperature, the resulting magnesia is heavier (sp. gr. 3.6 to 3.8), has no plasticity and will not recarbonate on exposure. In making magnesia bricks, a mixture of the two forms is employed—the light magnesia making up 16 per cent to 25 per cent.

Bibl.: R. VI, Pt. I, p. 119; XII, p. 328; XIII, p. 505; Bull. 38, pp. 327–334; U. S. G. S. Bull. 355; Min. Res. 1886, p. 696; 1891, p. 584; 1903, p. 1134; 1904, p. 1172; 1912, Pt. II, pp. 1072–1077; CEMENTS, LIMES AND PLASTERS, E. C. Eckel, 1905, pp. 149–167.

Berthenia Mine, in Soda Canyon, 12 miles east of Rutherford, S. H. Delmater, Chiles, owner; and adjoins the Matthai group. It has been idle for several years.

Bibl.: R. XII, p. 328; XIII, p. 505.

Blanco (see *Snowflake*).

Cleveland (see *Matthai*).

Matthai Mines. This group is owned by Frank Matthai, St. Helena, R. F. D., and located in Sec. 36, T. 8 N., R. 4 W., the "North Mine" (formerly Cleveland) being in Soda Creek Canyon just above the road, and the "South Mine," ¼ mile to the southeast and on the north bank of Greasy Camp Creek. At the former magnesite outcrops in irregular masses in the serpentine, but at the latter there is a 5-foot vein of good quality. Several years ago, a fair tonnage was shipped from surface cuts here; but nothing has been done of recent years.

Bibl.: Bull. 38, p. 328; U. S. G. S. Bull. 355, p. 31.

Pope Valley Deposit (*Walters,* also *White Rock*). There are two claims White Rock and Fairweather in this group, owned by J. B. Duvall et al., Pope Valley post office, in Sec. 2, T. 9 N., R. 5 W., 14 miles northeast from St. Helena, and 16 miles from Rutherford, its shipping point. The older of these two claims—"White Rock"—was located in the '70s, but no mineral was shipped from it till about 1894. A total of about 2000 tons is reported to have been shipped during a period of five years, since which no production has been made except a small tonnage in 1912. The deposit is about 400 feet above the level of Pope Creek, on an open hillside, bare except for scattered chamiso brush, and the bold white outcrop and quarry face can be seen from the valley below for several miles around. There are three main groups of veins—two on the east side and one on the west side of a small ravine—the entire grouping totaling a width of over 300 feet on the surface. The country rock is a "serpentinized lherzolite" (U. S. G. S. Bull. 355, p. 28). The western vein of the main east group shows up to 10 feet wide, of which 5 feet on the footwall is solid white magnesite, the upper 5 feet containing inclusions of serpentine. The veins strike northwest and dip to the east. The deposit is prospected by 400 feet of tunnels and a shaft of 90 feet, besides several surface cuts. Most of the magnesite is high grade and pure white, but in the large cut there is considerable cream-colored material. The geology of the deposit is described in detail in the references noted.

Bibl.: Bull. 38, p. 330; U. S. G. S. Bull. 355, p. 28.

Priest Mine. On the Priest ranch in Chiles Valley, in Sec. 23, T. 8 N., R. 4 W., 13 miles north of east from Rutherford, there is a deposit of magnesite, on which some development work was done, but it has been idle since about 1900. Mrs. D. C. Priest, St. Helena, is the owner.

Bibl.; Bull. 38, p. 328; U. S. G. S. Bull, 355, p. 31.

Russell Deposit. In Sec. 24, T. 8 N., R. 4 W., in Chiles Valley, 15 miles from Rutherford, there are several small veins outcropping, and a small tonnage was shipped at one time, but nothing has been done of recent years. T. B. Eddington, Napa, agent.

Bibl.: Bull. 38, p. 329; U. S. G. S. Bull. 355, p. 31.

Snowflake and Blanco Mines. These mines are in Sec. 29, T. 8 N., R. 4 W., 11 miles south of east from Rutherford, and about 2 miles south of the old Chiles mill in Chiles Valley. The present owners are San Francisco parties; T. B. Eddington, Napa, agent. Operated by Stanley and Bartlett, these mines, as already noted, began shipments in 1891, and produced over 1000 tons of magnesite per year for a period of nine or ten years. The ore was calcined before shipment, in wood-burning kilns. The country rock is a dark green to black serpentine, and the veins are from 1 to 6 feet in thickness. Some of the veins are considerably mixed with serpentine, and there is extensive silicification along the footwalls of some. In the brecciated portions there is crystalline magnesite, pale green to yellowish green in color. Analyses of magnesite from this property are given in U. S. G. S. Bull. 355 (loc. cit.). No work has been done of recent years.

Bibl.: R. XII, p. 328; XIII, p. 505; Bull. 38, p. 329; U. S. G. S. Bull. 355, pp. 29–31; Min. Res. 1891, p. 584.

Walters (see *Pope Valley*).

White Rock (see *Pope Valley*).

MANGANESE.

There are specimens of manganese ore in the Mining Bureau museum from near St. Helena by J. Graham and by F. W. Keeney; also from Moore Creek by R. A. Coleman; but the deposits are undeveloped. The former, which is in Sec. 19 or 20, T. 7 N., R. 5 W., 3 miles west of Oakville, has recently been located by Thos. P. Bacon, 1446 Fernside boulevard, Alameda, and F. W. Keeney.

MINERAL PAINT.

The *Carl Browne* paint mine is on Benali mountain, 2 miles south of Calistoga, but has been abandoned for several years.

William Hansen reports that he has mineral paint near the Carl Browne deposit.

The property formerly known as the *Paint M. and M. Company,* or the California Paint M. and M. Company, 1½ miles east of Calistoga, is now owned by Mrs. Ellen M. Knoles. No work has been done on it for several years.

Bibl.: Bull. 38, p. 339.

MINERAL WATER.

As regards mineral springs, Napa County has many of the characteristics noted under this heading in the description of Lake County (*q. v.*). Napa, however, is more advantageously situated in the matter of transportation facilities. The Napa Valley runs northwesterly and southeasterly along the entire western side of the county, and has two lines of railroad (the Southern Pacific, and the Napa Valley Electric) connecting with tidewater at Vallejo and terminating at Calistoga in the north. Chiles, Pope and Berryessa valleys are in the eastern half of the county, and are connected with the western part by well kept county roads.

Ætna Springs. The Ætna Springs, owned by the Len D. Owens Company, are in Sec. 1, T. 9 N., R. 6 W., on a branch of Pope Creek, 16 miles north of St. Helena. Elevation 1000 feet (barometric reading). Lidell post office is at the springs. This property, now covering 1000 acres, includes the old Valley quicksilver mine, which was a producer of that metal in the later '60s and early '70s. It is maintained as a family pleasure resort, and is now kept open throughout the year. It is attractively situated and well kept, many improvements having been made of recent years. There are 5½ acres of lawn about the main buildings. There are accommodations for 130 guests. Water from the "Ætna" spring is bottled for sale. The following are the temperatures of the principal springs: "American Ems," 93° Fahrenheit (so-called from its similarity to the famous Ems of Germany); "Iron," 77°; Ætna, 68° (also called "Potassium"); "Soda," 94°; one other, 4 feet from "Iron," 86°. There are sulphur incrustations around the iron spring.

Bibl.: R. II, p. 10; IV, p. 330; VI, Pt. I, p. 68; VIII, p. 416; XI, p. 72; XII, p. 341; XIII, pp. 514, 597; U. S. G. S. Mon. XIII, pp. 371, 402; Bull. 32, pp. 203, 210; Water Sup. Pap. 338, pp. 156–159; Geol. Surv. of Cal., Geol. Vol. I, p. 91; Min. Res. W. of Rocky Mts., 1873, p. 11; W. Anderson, "Mineral Springs and Health Resorts of California," pp. 69–72.

Calistoga Hot Springs. These springs, among the earliest known in California, are on the eastern edge of town, hardly five minutes walk from the railroad stations. This property, covering 108 acres, was owned for many years by the Leland Stanford Estate and rented for resort purposes; but in August, 1913, it was sold to H. S. White, 650 Brannan street, San Francisco. The new owner is planning to build a 100-room hotel, pipe the hot water to it from the springs, and otherwise improve the property. The design is so planned that other wings may be added as future demands may require. Because of the refusal to give a long-time lease, the place has remained without adequate improvements heretofore. Being situated on two railroad lines, and within about three hours ride of San Francisco, these springs have the making of an excellent resort.

The elevation is 365 feet (Southern Pacific Company). There is a flat, semimarsh area of 200 acres or more on the eastern side of Napa Creek, in which the hot sulphur springs occur. It is necessary to dig down only a foot or two anywhere in this area to get hot water. The mud is said to yield native quicksilver, on panning. The following temperatures were observed: 135° F. (well with hand pump); 171° (curbed with a barrel); 82°; 160° (much H_2S); 124°; 111°; 153°; 158° and 156°. The odor of sulphuretted hydrogen gas is more or less noticeable at all of them. It is stated that bathing in these hot waters has proven efficacious in the treatment of rheumatism and similar complaints. No water is bottled from these springs.

Bibl.: R. I, p. 8; VI, Pt. I, p. 67; VIII, p. 416; X, pp. 349, 355; XII, p. 341; XIII, p. 514; U. S. G. S. Bull. 32, pp. 204, 210; Mon. XIII, p. 403; Water Sup. Pap. 338, p. 108; Geol. Surv. of Cal., Geol. Vol. I, p. 87; W. Anderson (op. cit.) pp. 114–116.

Congress Spring. Jessie W. Hamilton, owner; 3½ miles southwest of Napa.

Bibl.: U. S. G. S., Water Sup. Pap. 338, p. 156.

Guillaume's (see *Pope*).

Hotel Calistoga. The Hotel Calistoga is on Lincoln avenue in the center of town of Calistoga; Owen Kenny, owner; B. F. Hughes, manager. There is a bored well from which hot water is pumped to a large concrete swimming pool and to a tank for bath service in the hotel. Water was struck at 2 feet depth, and tapping the same subsurface hot sulphur water as characterizes the Calistoga Hot Springs. When the pump is not running the well overflows a small stream. The temperature is 112° F. at the pump discharge.

Bibl.: W. ANDERSON (op. cit.), pp. 114–116; U. S. G. S., Water Sup. Pap. 338, p. 108.

Indian Spring (see *Pope*).

Jackson's (see *Napa Soda*).

Lathrop Hot Sulphur and Mud Spring, 1 mile south of Calistoga. This is similar to the Calistoga hot springs. There is a small bath establishment here, used locally.

Myrtledale Farm. This resort, 2 miles northwest of Calistoga is in a flat semimarsh area of 50 acres or so, similar in character to that in which the Calistoga hot springs are located, but is nearly 200 feet higher above sea level (550 feet bar.). The owner is R. R. Leveira. There is a bored well on the place which flows a small stream when the pump is not running; temperature 99° F. at pump discharge. At 300 to 500 feet from this well, are several mud springs which have the following temperatures: 128°, 134°, 112° F. There are accommodations for thirty in tents.

Napa Rock (see *Priest's Soda*).

Napa Soda Springs. Familiarly designated for many years "Jackson's Napa Soda," this is one of the oldest and best known springs of California, both as a resort and from its bottled water. This water has been on the market since 1860, the plant at the present time having a capacity of 1000 dozen splits per day. Contrary to the usual practice, "splits" (3 per quart) are used here instead of "quart" bottles (5 per gallon). The bottles have "Napa Soda," etc., blown in them, so that it is not necessary to use any labels. The spring has an air-tight cap fitted over it to retain the gas, which is again mixed with the water by agitation during pumping to the automatic bottle filling machine. Electric power is used; and an ice machine is included in the installation. Ten men are employed, including drivers of two 6-horse teams, which haul the product to Napa, 8 miles south. The bottling works are operated throughout the year.

The springs are in Sec. 2, T. 6 N., R. 4 W., at an elevation of 900 feet (U. S. G. S.) and are owned by Chas. H. Jackson, with Fiege and Hennings, lessees. Napa Soda Springs is the post office. It is said that this series of chalybeate springs situated along the hillside overlooking the Napa Valley, was originally used by the Nah-pah Indians; and that the Spaniards called them "Soda de Nah-pah," which, previous to 1850, was shortened to the present form—Napa. Several of the buildings are of stone (see photos Nos. 39 and 41)—a volcanic tuff from a quarry on the property. The grounds are well laid out, with flowers, ferns, palms, trees, etc., and threaded by numerous, broad-cut trails. There is a swimming pool which, being above the level of the buildings, serves as an emergency reservoir in case of fire. There are accommodations for 230. The springs showed the following temperatures; "Lemon," 66° F. (flow, 1 gallon in 5 minutes); old bottling house spring, 67° (flow 1 gallon in 2 minutes); "Napa Soda," 67° (flow, 1 gallon per minute); "Pagoda," 66°. The last two have considerable excess gas (CO_2).

Photo No. 39. At Napa Soda Springs, looking down lower drive.

Bibl.: R. VI, Pt. I, p. 69; VIII, p. 416; X, p. 362; XII, p. 341; XIII, p. 514; U. S. G. S. Bull. 32, pp. 207, 211; Water Sup. Pap. 338, p. 155; W. Anderson (op. cit.), pp. 201–207.

Napa Valley Mineral Water Company (see *Priest's Spring*).

Napa Vichy Spring. This spring, situated on the edge of the Napa Valley, 4 miles northeast of Napa, at an elevation of 90 feet (U. S. G. S.), is owned by John Lepori. This water, which is lightly mineralized, was first bottled in 1895. Previous to that, the place was maintained as a resort. The bottled product is artificially carbonated. The bottling works use electric power. The temperature of the spring is 66° F.

Bibl.: U. S. G. S., Water Sup. Pap. 338, p. 255.

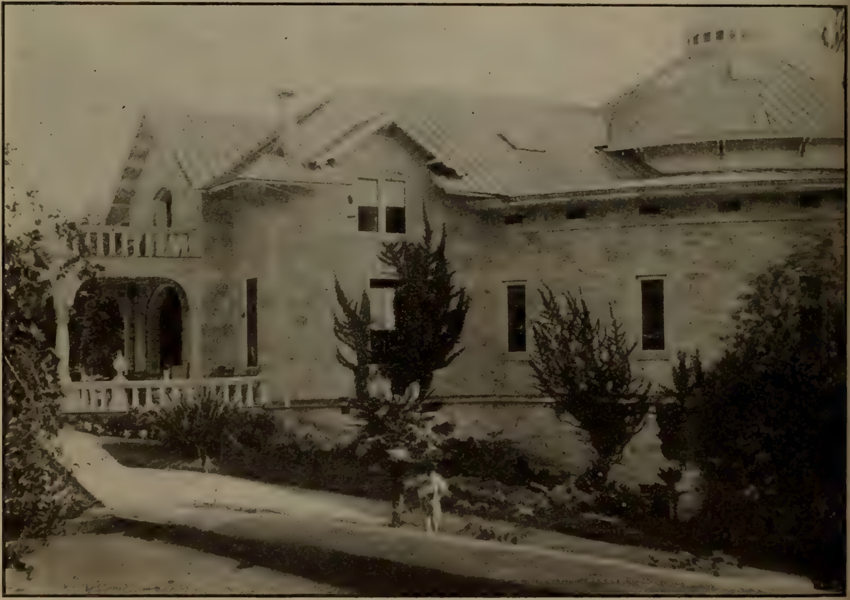

Photo No. 41. "The Rotunda" at Napa Soda Springs, Napa County.

Original White Sulphur Springs (formerly *White Sulphur Springs*). These springs are 2 miles south of west from St. Helena, in Secs. 3 and 4, T. 7 N., R. 6 W., at an elevation of 400 feet (bar.); John Sandford, owner. They are picturesquely situated, as there is considerable timber on the property (625 acres), consisting principally of redwood, "fir," and oak, with madrone and manzanita. The springs were discovered in 1845, and there have been three separate hotels destroyed by fire here. At present there are accommodations for 150, but it is intended to enlarge the capacity. No water is bottled for sale. The springs are all of the "white sulphur" variety, and sulphuretted hydrogen gas is given off from most of them. The following temperatures were observed: "Tank spring," 81° F.; back of bathhouse, 85°; "Mary Phillips' well," 78°; on road below "Mary Phillips," 83° (seepage rom rock wall of canyon, indurated sandstone); cold sulphur, 59° (on ank of creek); "Mission Father's well," 69°.

Bibl.: VI, Pt. I, p. 69; VIII, p. 417; XII, p. 341; XIII, p. 514; U. S. G. S. Bull. 32, p. 209; Water Sup. Pap. 338, p. 254; Geol. Surv. of Cal., Geol. Vol. I, p. 87; W. Anderson (op. cit.), pp. 263, 264.

Phillips Soda Springs, 15 miles east of St. Helena; Bank of Halfmoon ay, Halfmoon Bay, owner.

Bibl.: U. S. G. S., Water Sup. Pap. 338, p. 161.

Pope Mineral Spring (*Indian Spring*). This spring, owned by Peter uillaume, Yountville, is in Sec. 29, T. 9 N., R. 4 W., 21 miles northeast rom Rutherford, and a mile west of Samuels Soda Springs. Bottling egan in July, 1913. A portion of the water is put up at the spring, ut the major part marketed is hauled in barrels to Yountville and here bottled, carbonated.

Bibl.: U. S. G. S., Water Sup. Pap. 338, p. 162.

Priest's Soda Spring. This property, formerly a part of the Priest anch, is now owned by A. Meyer, 3650 Grove street, Oakland, operatng under the corporate name of Napa Valley Mineral Water Company. he bottling works are at St. Helena. The spring is in Sec. 23, . 8 N., R. 4 W., 16 miles east of St. Helena. The present owner was he first to bottle the water, in 1898. It is hauled in a tank wagon olding 500 to 600 gallons, and bottled, carbonated, under the name f "Priest Soda Water" and "Napa Rock." There are two springs, he one not bottled carrying iron and magnesium. The principal one s stated to flow 12,000 to 15,000 gallons per day.

Bibl.: U. S. G. S., Water Sup. Pap. 338, p. 161.

Samuel Soda Springs. These springs are in Sec. 28, T. 9 N., . 4 W., at an elevation of 775 feet (bar.) on Trout Creek, a branch f Pope Creek. They are 10 miles northwest of Monticello, 24 miles ortheast from Rutherford, or 30 miles northwest from Winters. They ave been utilized for about forty years, the present owner being Robert . Little. The water is hauled in drums to St. Helena and bottled y the St. Helena Bottling and Cold Storage Company. There are ccommodations at the spring for sixty boarders, in addition to which here are camping grounds, also. The following are the principal prings: "Samuel Soda," 62° F., "Kidney," 64°; others 60°, 62°, 63°, respectively. There is also a "magnesia" spring, ¼ mile from the hotel, and a "white sulphur" ½ mile distant.

Bibl.: R. XII, p. 341; XIII, p. 514; U. S. G. S. Water Sup. Pap. 338, p. 159.

Sequoia Resort. It is 8 miles northwest of Napa; elevation, 800 feet. Owner, Theo. Gier, Oakland. There are two springs—one fresh water, the other "sulphur," the latter of which is said to show, on analysis, in parts per million: sodium sulphate, 12.3; sodium chloride, 28.5; magnesium and calcium carbonates, 10. There are tents and cottages in addition to the hotel. C. M. Troppman is manager.

St Helena Bottling and Cold Storage Company (see *Samuel Soda*).

St. Helena White Sulphur (see *Original White Sulphur*).

Walters Springs. These springs are in Sec. 12, T. 10 N., R. 5 W., 16 miles northeast from St. Helena. H. L. Connor, owner; post office, Pope Valley. They are in a short side canyon on the north side of Pope Creek, at an elevation of 1170 feet (bar.), and are reached by a well graded wagon road. These springs have been known since about 1869, and in 1909 all of the buildings were destroyed in a forest fire. There are at present accommodations for fifty people. A small amount of water is bottled, regularly. There are two mineral springs—upper, 68° F.; lower, 66°. At both Walters and Samuel springs (5 miles to southeast) serpentine is the predominating rock. Between them there are sharp ridges of chert, along the north side of Pope Creek. Samuel Springs are on the south side of the creek.

Bibl.: U. S. G. S., Water Sup. Pap. 338, p. 159.

White Sulphur (see *Original White Sulphur*).

Zem Zem Spring (see under *Onyx Marble*).

ONYX MARBLE.

There are specimens of onyx marble in the museum of the State Mining Bureau, from a locality formerly called "Zem Zem," near Knoxville. The deposit is not developed. There are calcareous springs near-by.

Bibl.: Bull. 37, p. 111; Bull. 38, p. 369; W. ANDERSON (op. cit.), p. 269; U. S. G. S., Water Sup. Pap. 338, p. 268.

PAVING BLOCKS (see Stone Industry).

PETROLEUM.

Petroleum and gas have been found in small quantities in sandstone west of Napa and Yountville, but not developed.

The *East Napa Mining Company* drilled to a depth of between 1000 and 1200 feet at the southern edge of Napa City, and at that lepth claim to have found "oil indications," though they did not xpect oil until a depth of 2500 feet was reached. Work stopped for ack of funds. A. Zeller owns the property.

Bibl.: R. XIII, p. 582.

QUICKSILVER.

Development work began on the quicksilver mines of both the Knoxville and the Pope Valley sections about 1860. In the former, the Lake (afterward merged with the Manhattan) was the pioneer, followed closely by the Redington; and in the latter district, the Valley mine (now a part of the Ætna mineral springs property) was the first. Although the industry had its ups and downs, Napa County was one of California's most important producers from 1864 to 1903, since which later date the decline has been very rapid. Though the present outlook is not particularly encouraging,* the success attending concentration experiments at the Ætna and Oat Hill mines, gives promise of at least a partial revival. (For more extended remarks regarding concentration, see introduction to Quicksilver under Lake County.) As has already been noted, Napa County's quicksilver mines are credited

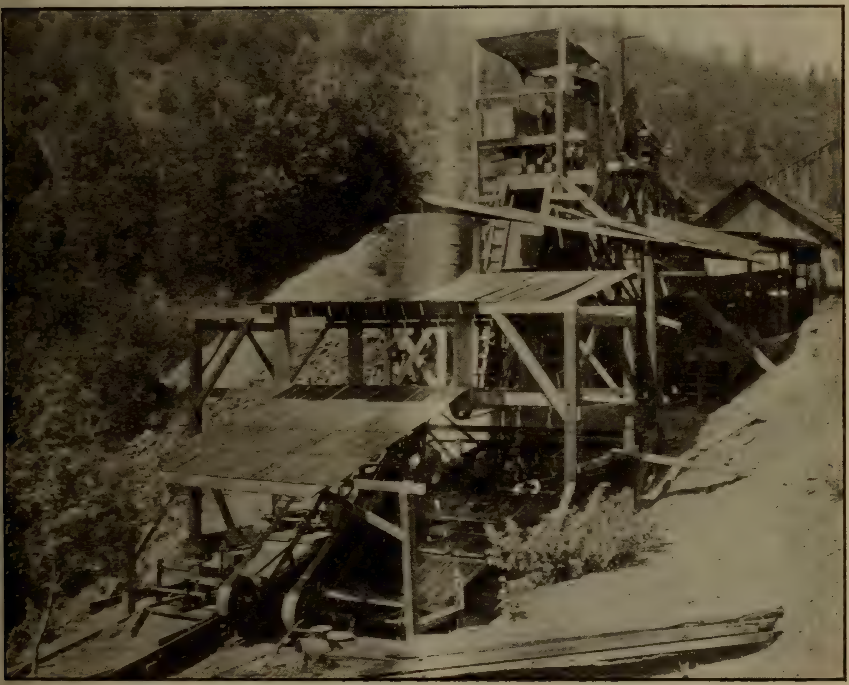

Photo No. 29. Mill at Ætna Quicksilver Mine, Napa County.

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*Since the above was written, the price of quicksilver has more than doubled as a result of the European war.

officially with a production valued at $15,000,000, but with a reputed output in excess of $22,000,000.

Ætna Quicksilver Mine (formerly *Ætna Consolidated*). The Ætna group is at the southeast end of the Mayacmas district near the head of a branch of Pope Creek, on the ridge separating it from James Creek. It is in Secs. 2 and 3, T. 9 N., R. 6 W., 2 miles southeast from the Oat Hill mine and 9 miles northeast of Calistoga, though St. Helena (18 miles) is its railroad shipping point on account of better roads and easier grades. Post office is Lidell. The group consists of Phoenix, Silver Bow, Red Hill, Washington, Pope, and Star claims, all patented. Quicksilver ore is said to have been discovered here in 1854 by Lawley. It was later sold to Haufmeister et al., then to the Ætna Consolidated Quicksilver Company; then in 1904 the present owners, Lawley Brothers, Calistoga. Bror Soderhjelm, Lidell, is lessee. The earliest production was from the Phoenix. The most important producing periods of the Ætna group were between 1877 and 1887, and for about six years beginning with 1892. As the early figures were not segregated the total output can not be stated exactly, but it is estimated to be in excess of 36,000 flasks. The last two or

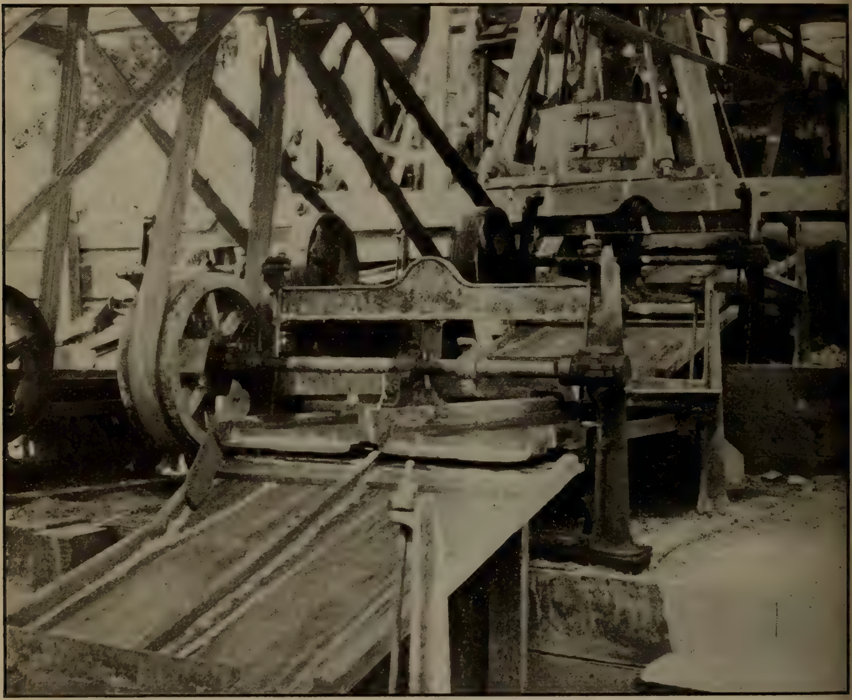


Photo No. 30. Concentrators in Mill of Ætna Quicksilver Mine, Napa County.

three years that the Ætna Consolidated Company had the mine mainly prospecting was done. In 1910–1912, a small production was made from clean-up by leasers around the old furnaces, and the retorting of small lots of sorted ore. An extended description of the geology and the underground workings is given in Bulletin 27, pp. 72–76; and in U. S. G. S. Monograph XIII, pp. 354, 371–374. In the Star mine, the shaft reaches a depth of 800 feet, and in the Silver Bow the tunnel (No. 9, in 3557 feet) attains a depth of 900 feet below the outcrop. No. 7 tunnel (7226 feet long) starts in the Phoenix and goes into the Silver Bow, while No. 9 (200 feet lower) starts in the Star and is driven into the Silver Bow. It was in the Silver Bow ground tapped by these two tunnels that the largest and most important ore body of the group was found, during the Ætna Consolidated regime. Above the No. 7 the vein was not over 3 or 4 feet wide, and with a steep dip. At that depth it flattened out, and widened to 20 feet between walls, extending to the No. 9—a veritable bonanza. Of mineralogical interest, it may be mentioned here that millerite (nickel sulphide) has been noted in the Ætna mine associated with cinnabar.

The present lessee has built a concentrating mill (see photos No. 29 and No. 30), which at the time of our visit (September 1, 1913) was equipped with a Dodge crusher, Griffin mill and six Gilpin County bumping tables, the whole being operated by a 40 h.p. distillate engine. It was observed that the Griffin mill made a considerable proportion of slimes. The Gilpin County bumpers seemed to collect most of the coarser cinnabar, but lost the fines. As we have already pointed out (see Lake County, introduction to quicksilver), it is very important to avoid sliming of cinnabar, as it is extremely friable. The use of a common power unit for both crushers and concentrators is also objectionable for effective concentration, on account of the variations of speed caused by the rock breaker. Having discussed these points with Mr. Soderhjelm at the time above noted he writes, under date of January 23, 1914, that he has taken out four of the bumpers and put one New Standard (Llewellyn Iron Works, Los Angeles) table in their place, ''but the Standard table had too much to do; so I have ordered another, and if that is not enough I will have some more of the same kind, as the Standard seems to take kindly to the slime.'' Also, the concentrators are now being driven by a separate 5 h.p. engine. Ore from the surface cuts is soft and clayey, while that from underground is in part hard and siliceous. The capacity of the mill is stated to be 64 tons per eight hours. An 18-mesh screen is used on the Griffin mill. The concentrates are reduced in two ''D'' retorts, arranged with both a fan and a water-jet for draught. In the same letter above quoted: ''I found that lime was not so good as charcoal with air in the retort, and I have to use lots of it, too, besides shaking it up two or three times." He had (September, 1913) seven men at work in the mine and five in the mill. Only hand drilling is done, and the ore is trammed by hand.

> Bibl.: R. V, p. 96; XI, p. 72; XII, p. 362; XIII, p. 597; Bull. 27, pp. 72–76; U. S. G. S. Mon. XIII, pp. 354, 371–374; Min. Res. 1884, p. 492, 1892, p. 148, 1902, p. 252, 1909, Pt. I, p. 553, 1910, Pt. I, p. 698, 1911, Pt. I, p. 901, 1912, Pt. I, p. 942; Min. Res. W. of Rocky Mts., 1872, p. 523, 1873, p. 11, 1874, p. 30, 1876, p. 20; Geol. Surv. of Cal., Geol. Vol. I, p. 91; Eng. and Min. Jour., November 1, 1913, p. 828.

Bella Union Quicksilver Company. The Bella Union Company, W. H. Hamilton, 556 Mills Building, San Francisco, attorney, owns the Bella Union and Oakville mines in Sec. 20, T. 7 N., R. 5 W., 1½ miles west of Oakville. The Oakville was a producer in 1872–73 (about 400 flasks) and the Bella Union is credited with 271 flasks in 1876; but the exact total figures are not available. The ore carries cinnabar with pyrite and calcite, and "forms seams in the slates and irregular bunches connected by stringers of ore" (Becker). In October, 1909, the Bella Union Company gave a working contract for the purchase of the mine, under which contract certain of the old tunnels were opened up, exposing some good ore. About April, 1910, work under the contract ceased and the contract forfeited; but the holder brought suit to have the company deed over the property upon payment of the agreed purchase price. The company prevailed in the suit. No work has been done since that time.

> Bibl.: R. IV, p. 336, table; X, p. 362; XII, p. 364; XIII, p. 599; Bull. 27, p. 76; U. S. G. S. Mon. XIII, p. 377; Min. Res. 1909, Pt. I, p. 553; Min. Res. W. of Rocky Mts., 1873, p. 11; 1874, p. 30.

Boston Mine (see *Redington*).

Calistoga (see *Calistoga Hot Springs* under *Mineral Water*).

Corona Mine. The Corona is owned by the Vallejo Quicksilver Mining Company, J. B. McCauley, president; E. J. McCauley, 409 Carolina street, Vallejo, secretary. It is in Secs. 32 and 33, T. 10 N., R. 6 W., 9 miles southeast of Middletown, between the Oat Hill on the northeast and Twin Peaks mine on the south; elevation 2200 feet (bar.). The mine is on the contact of the sandstone of the Oat Hill mine and a serpentine belt. The geology of the deposit is described in Bulletin 27, page 79. The mine was opened up in 1895, but closed down in 1906, following a heavy winter, being driven out by water in excess of the pumping capacity. They also had furnace troubles on ccount of the large amount of pyrite occurring with the cinnabar. 'he pyrite rendered the ore self-burning, making it difficult to regulate ıe furnace temperatures, and the condensing. A white powder (prob-bly sulphate of mercury) formed as an incrustation in the condensers, ıe result of reaction between the released quicksilver and SO_2 gas. 'his incrustation had to be broken out and retorted. The furnace, of ıe Scott type, is of 50 tons capacity. The mine is credited with a ɔtal production valued at $250,000.

Bibl.: R. XIII, p. 597; Bull. 27, p. 79; U. S. G. S. Min. Res., 1902, p. 252; 1908, Pt. I, p. 686.

Etna Mine (see *Ætna*).

James Creek prospect (see *Philadelphia*).

Knoxville Mine (*Boston, Redington*). This mine, known for years s the Redington, and later as the Boston, was first called ''Excelsior'' Geol. Surv. of Cal., Geol. Vol. I, p. 92), being owned by the X. L. C. R. ining Company. It was discovered in cutting a grade for a highway, nd first appears in the producing column with 444 flasks in 1862. n 1867, the company was reorganized as the Redington Quicksilver 'ompany. The present owner is F. E. Johnston, 4 Masonic Temple, 'apa. The mine continued an important producer up to 1883. From hat time to 1893 the output was only nominal (126 to 881 flasks er year), followed by five years of prosperity, since which, with ıe exception of 1908, the production has been small. The total has een 115,933 flasks to the end of 1912, exceeded in California (which lso means the United States) by only two mines—New Almaden and 'ew Idria. It is at Knoxville in the northeast corner of Napa County.

The geology and the underground workings are described in detail ı several of the reports noted under Bibliography. There are three arallel, principal veins in the mineralized zone, and enclosed in serpen- ne. The cinnabar is associated with pyrite and quartz, the gangue ıineral being principally a black opaline, in part resembling obsidian. ulphurous waters in the mine are said to have caused trouble with 'on pipes and machinery. At the time of our visit, one ''D'' retort 'as in operation, putting through a little sorted ore with material rom the old Scott fine-ore furnace, which was being torn down. The re was from the 150-foot level of the intermediate shaft (west of line between the two older shafts), where a small body of fair grade re was being blocked out. Three men underground (one miner, single- and drilling, and two muckers) with five on top (including foreman nd Chinese cook) were at work. Ore was hauled by wagon to the etort. Extensive tailings dumps around and below the furnaces indi- ate the former activity of this mine, which at one time employed over

600 men. During the seventies, the Redington Company had a contract with the Comstock mines for 400 flasks of quicksilver per month.

Bibl.: R. IV, pp. 179, 261, 289, 317, 329, 336 (table), 339, 340; VI, Pt. I, p. 122; X, p. 358; XI, pp. 69–71; XII, p. 363; XIII, p. 599; Bull. 27, pp. 76–79; U. S. G. S., Mon. XIII, pp. 10, 271–290, 464; Min. Res., 1883, pp. 394–396; 1884, p. 492; 1892, pp. 148, 160; 1902, p. 251; 1907–1912 (inc.), Pt. I; Geol. Surv. of Cal., Geol. Vol. I, pp. 92 and 99; Vol. II, pp. 128–132; Min. Res. W. of Rocky Mts., 1867, p. 178; 1868, p. 264; 1871–1876 (inc.); Trans. A. I. M. E., Vol. III, pp. 279, 285, 292, 301.

Lake Mine (see *Manhattan*).

La Joya Mine. Owned by James Rennie, Olympic Club, San Francisco, is in Sec. 24, T. 7 N., R. 6 W., 3 miles southwest of Rutherford. The property has been idle for several years, only a watchman being in charge.

Bibl.: Bull. 27, p. 80.

Manhattan Mine. This group, which includes the old Lake mine, is owned by the Lake Mining Company; R. B. Knox, Pacific Building, San Francisco, president. Besides the mining claims, the company has 320 acres of land in addition. It is in Sec. 6, T. 11 N., R. 4 W., and Sec. 1, T. 11 N., R. 5 W., 1 mile northwest of Knoxville and 20 miles southeast from Lower Lake. The mine was first worked in 1863, the place being then known as Johntown, and the ore reduced in the furnaces of the Redington mine. It was idle from 1877 to 1884, from which time to about 1907 it was again in the producing list. Its total production has been 15,933 flasks. No work has been done recently. As the mine and its geology have been described at considerable length in Bulletin No. 27, and in U. S. G. S. Monograph XIII, it will not be entered into here.

Bibl.: R. IV, p. 336, Table; V, p. 95; VI, Pt. I, p. 33; VIII, p. 412; XI, p. 71, 72; XII, p. 363; XIII, p. 598; Bull. 27, pp. 81–89; Geol. Surv. of Cal., Geol. Vol. I, p. 92; Vol. II, pp. 126–128; Min. Res. W. of Rocky Mts., 1867, p. 178; 1871, p. 15; 1874, p. 30; 1876, p. 20; U. S. G. S. Mon. XIII, p. 282; Min. Res., 1892, pp. 147, 160; 1902, p. 252; 1908, Pt. I, p. 686.

Mountain View (see *Simmons*).

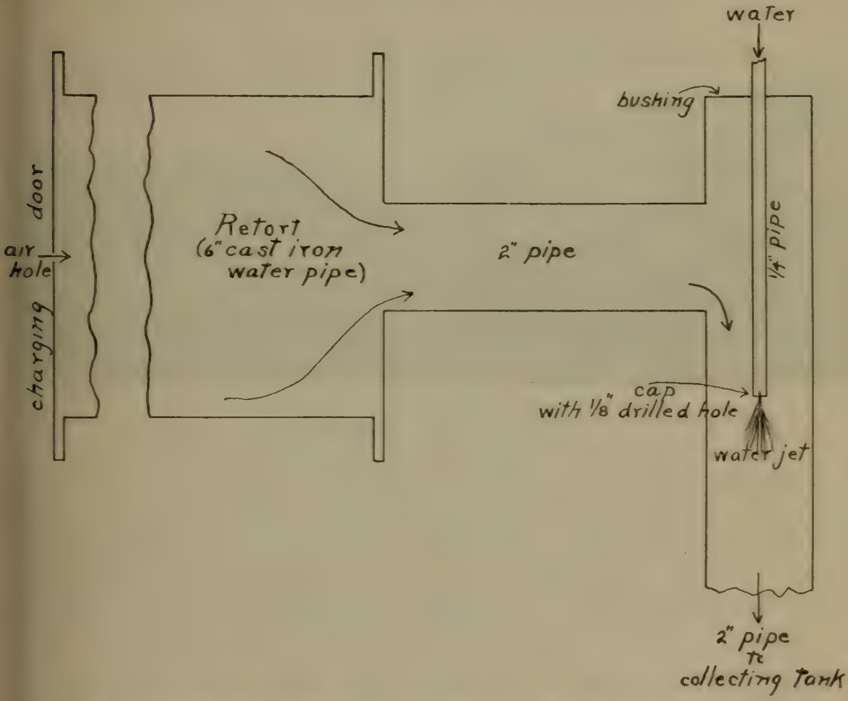
Napa Consolidated (see *Oat Hill*).

Northern Light prospect about 2½ miles west of Knoxville, near Lake County line; Fr. Josh, Lower Lake, owner. Idle.

Bibl.: Bull. 27, p. 92.

Oakville Mine (see *Bella Union*).

Oat Hill Mine (*Napa Consolidated*). This mine was for many years one of the important producers of California, having been opened up in 1867 and operated continuously up to 1909, when it was closed by the Napa Consolidated Company as being worked out. The present owner, E. J. Sittig, Berkeley, took it over in 1910. R. P. Newcomb, Middletown, is lessee. There are 17 claims in the group, all patented, lying at the junction of Secs. 27, 28, 33 and 34, T. 10 N., R. 6 W., between James and Bucksnorter creeks, and 9 miles southeast of Middletown. The total production is stated to have been between $5,000,000 and $6,000,000 in value.



Plan of water-jet condenser for quicksilver retort at Oat Hill Mine, Napa County.

The older worked ore shoots were on the Mercury and Manzanita veins, the later developments being to the southwest and around on the other side of the ridge, on the Escape, Eureka, Humboldt and Osceola veins. While the ore was connected with the veins and on their footwall, there was little cinnabar in the siliceous vein matter itself. The values occurred almost entirely as impregnations in the soft, light gray sandstone. The lenses of ore were all near to the surface, the deepest one, on the Eureka, reaching only a depth of 400 feet. In places, the stopes broke through to daylight. The largest single lenses were opened upon the Humboldt and Osceola veins, in both cases being stoped for a length of 500 feet. During the last two years that the Napa Consolidated Company operated, the territory outside of the zone explored by underground operations was prospected by boring numerous holes to a depth of 200 to 350 feet from the surface, with a Davis-Calyx core drill. During their last year, no underground development was carried on, only the ore then in sight being extracted.

Photo No. 28. Dumps of low grade ore at Oat Hill Quicksilver Mine, Napa County, from Eureka, Osceola and Humboldt veins.

It is estimated from the maps of the property that there are over 21 miles of underground workings in the mine. The elevation is 2250 feet (bar.) at the office. Equipment included two 50-ton Scott furnaces, which were dismantled and cleaned up when the mine was closed.

The present lessee, R. P. Newcomb, during the summer of 1913, had in operation one New Standard concentrating table (Llewellyn Iron Works, Los Angeles,) as a trial plant, screening, sluicing and concentrating material from the old, low-grade, mine dumps. At the time of our visit (September 1st) he was shipping in two additional tables, a revolving screen and another gasoline engine. A 5 h.p. engine operates the screen and a 1½ h.p. engine the concentrators. He estimates that there are in excess of 250,000 tons of ore on the dumps (photo No. 28 shows part of them) which can be economically treated by this method, and that he can handle at a profit material carrying as low as 0.15 per cent quicksilver (3 pounds per ton). Being a friable sandstone with impregnated cinnabar, and having lain out in the weather for some years, it is more or less disintegrated and air-slaked, requiring no crushing; so that it is particularly favorable for low-cost concentration treatment. The concentrates are retorted in a series of pipe retorts, using a water jet for draught and condensing purposes (see sketch). From the test plant runs Newcomb estimated that he could handle the material for about 40 cents per ton, or a cost of $10 per flask of quicksilver reduced, on a 0.15 per cent Hg basis. Four men are required for the 3-table plant to dispose of 50 tons daily. On the trails and roadways about the Oat Hill mine, after a rain, cinnabar can be seen concentrated among the rocks and small crevices of the water courses.

Bibl.: R. V., p. 96; VIII, p. 413; X, p. 270; XI, pp. 65, 72; XII, p. 364; XIII, p. 598; Bull. 27, pp. 89-91; U. S. G. S. Mon. XIII, pp. 354-358, 469; Min. Res., 1883, pp. 394-397; 1884, p. 492; 1888, p. 97; 1892, pp. 145, 160; 1902, p. 251; 1906, p. 497; 1907, Pt. I, p. 679; 1908, Pt. I, p. 686; 1909, Pt. I, p. 553; 1910, Pt. I, p. 698; 1911, Pt. I, p. 902; ENG. & MIN. JOUR., Nov. 1, 1913, p. 828.

Philadelphia (*James Creek* prospect). This prospect is near (southeast from) the Oat Hill mine. It has been abandoned since the death, a year or two ago, of the owner, Martin Pluth.

Bibl.: Bull. 27, p. 93.

Phoenix Mine (see *Ætna*).

Redington Mine (see *Knoxville*).

Silver Bow Mine (see *Ætna*).

R. C. Simmons, Yountville, has a quicksilver prospect in Sec. 2, T. 6 N., R. 5 W., about 1½ miles west of Yountville. It was worked some years ago, but is idle at present. This is probably the ''Mountain View'' (Rep. X, p. 362).

Summit Mine. It is 3 miles southwest from Rutherford, and was a producer in the early seventies. Idle.

Bibl.: R. XII, p. 365; XIII, p. 599; Bull. 27, p. 92; MIN. RES. W. OF ROCKY MTS., 1874, p. 30.

Twin Peaks Mine. This mine near Oat Hill joins the Corona mine on the south, and is in Sec. 33, T. 10 N., R. 6 W., about 10 miles south of Middletown. It is owned by W. H. and E. L. Herrick, Middletown. The mine has been closed since 1906, in the two years previous tc which it had produced a total of $40,000 in quicksilver from a lens of ore. As the surplus is stated to have been all paid out in dividends and none used for further development, the mine was closed for lack of funds for development, when the pocket had been worked out. Assessment work only has been done since.

Bibl.: Bull. 27, p. 92; U. S. G. S., An. Rep. XXI, Pt. VI, p. 278; MIN. RES., 1902, p. 252; 1907, Pt. I, p. 679; 1911, Pt. I, p. 902.

Valley Mine (see *Ætna Mineral Springs,* under *Mineral Water*).

Washington Mine (see *Ætna*).

Whitney Prospect. This prospect is in Sec. 21, T. 10 N., R. 5 W., 10 miles southeast of Middletown, on agricultural patented land owned by G. B. Whitney of Calistoga; Oscar Jacobson, Lidell, lessee. The property was not visited, but we were shown specimens of the ore, which is an impregnation of cinnabar in a schistose sandstone. The country rock is said to be sandstone and serpentine. Development consists of a short drift and winze, and several prospect holes. Jacobson writes he has ''found ore for 50 feet across the ledge.''

SAND AND GRAVEL (see Stone Industry).

SANDSTONE (see Stone Industry).

SILVER (see Gold and Silver).

STONE INDUSTRY.

Under this heading is included building stone, crushed rock, macadam, paving blocks, rubble, sand and gravel, and sandstone. In the hills along the western side of the Napa Valley basalt occurs, which has been quarried for paving blocks near St. Helena and Napa. At the surface, it appears mostly in the form of boulders which are the result of disintegration along cracks and flow lines. The interior of the boulders is for the most part hard, bluish and compact. There are occasional vesicles. Along the eastern side of the valley trachytic tuffs are abundant. There is considerable variation in texture and hardness, but much of it is suitable for rough work such as bridges, walls, and rubble construction. Wooden and iron bridges throughout Napa County have gradually been replaced by stone. The same liberal policy is also maintained by the county in road construction and repairs; so that it is a pleasure to ride or drive over its well-kept roads with their picturesque stone bridges (see photos Nos. 35 and 43). The rock is taken from the quarry nearest to the point where it is to be utilized. Napa County is more fortunately situated than many other counties of the State in thus having close at hand an abundant supply of stone suitable for such purposes. Even where stone work is more expensive than in this county, it would still be economical in the long run as it makes a more permanent structure as well as picturesque, when compared to wood or even steel.

Sandstone is found in the ridges surrounding Berryessa, Pope and Wooden valleys, which are east of the main Napa Valley.

Bachelder Quarry, C. S. Bachelder, Napa, owner. It is on the eastern edge of the city, at an elevation of 100 feet (U. S. G. S.), and ¾ mile from tidewater. The rock is a reddish rhyolite, in part compact, fine-grained, felsitic, and in portions of the deposit partly altered by devitrification and leaching. The quarry was opened up in 1908. The crushing and screening equipment, driven by gasoline engine, has a capacity for handling 125 tons per nine-hour day. No rock was taken out in 1913. The product is used for road and concrete work.

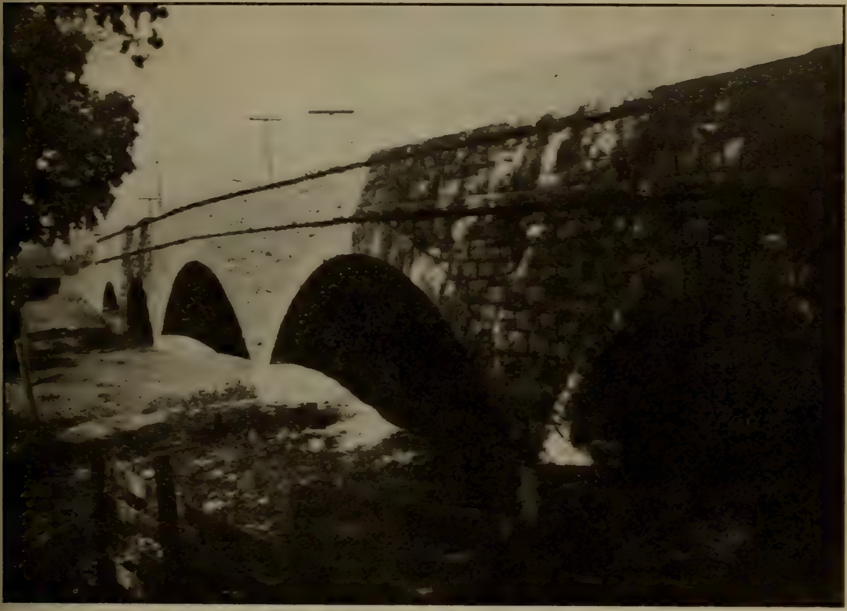


Photo No. 35. "Little Trancas" bridge, near Napa, Napa County. Stone from Wing Quarry, 1908.

Bieber Quarry, P. P. Bieber, St. Helena, owner. It is 1 mile northwest from St. Helena post office and ¼ mile from the county road, at an elevation of about 500 feet. The rock is basalt and was first quarried in 1911 under lease, for paving blocks. Not operated in 1913.

Brown Quarry, Mrs. M. Myers, Fairfield, owner. It is 2 miles southeast of Calistoga, and was originally part of the Nettie Brown ranch. The stone is trachytic tuff and has been used locally for building purposes. No production has been made for several years past.

Bibl.: Bull. 38, p. 155.

Buck Ranch. Rock for county road work was quarried from the Buck ranch, southwest of Napa, in 1911.

Carver Quarry (see *Jursch*).

Connors Quarry or "Cement Rock Pit," N. Connors, Calistoga, owner. It is in the western part of Calistoga, on the side of a hill running southeasterly. The material is a tough, clay-like in part, volcanic ash or tuff, and has been used locally for a number of years as a road dressing. It is said to pack quite hard after wetting.

Davis Quarry, Dr. C. E. Davis, St. Helena, owner. On the Davis ranch, 2 miles from St. Helena on the Sanitarium road, is a hard, reddish trachytic tuff which has been used locally for building purposes. At the time of our visit rock was being taken out for the bridge at the north end of Main street, St. Helena. Dr. Davis also owns a deposit of softer stone nearer town on the same road, but no quarrying has been done there.

Photo No. 43. "Big Trancas" bridge near Napa, Napa County. Stone from Wing Quarry, 1913.

Bibl.: Bull. 38, p. 155.

Errington Quarry, George E. Errington, Napa, owner. This quarry, about 1 mile east of the railroad station at Napa, produces crushed rock for road metal and concrete work. The crushing plant has a capacity of 100 cubic yards per day, and is driven by a gasoline engine. Four sizes of product are made. It is operated only about six months per year, principally in the summer season. Fourteen men are employed when in full operation. The rock is rhyolite similar to that at the Bachelder quarry, north of this.

Bibl.: Bull. 38, p. 320.

Gardner Quarry, W. G. Gardner, Napa, owner. This sandstone quarry is in Wooden Valley about 10 miles northeast of Napa. The stone is a light buff in color, and fine-grained; and has been used principally for building bridges in the vicinity, though some has also been used for road metal. Idle in 1913.

Bibl.: R. XIII, p. 636; Bull. 38, p. 131.

Harris Ranch. The county has contracted for about 15,000 cubic yards of crushed rock for road work in 1914 to be taken from the Henry Harris ranch southwest of Napa.

Howell Mountain Quarry, H. Overacker, St. Helena, owner. This quarry of trachytic tuff is on the east side of the ridge, elevation 750 feet, on the Glendale ranch, 3 miles northeast of St. Helena. From it, stone of fair-sized dimensions has been taken. Stone from this quarry was employed in the new St. Helena High School building erected in 1912 (see photo No. 32).

Photo No. 32. St. Helena High School. Stone from Howell Mountain Quarry, Napa County, 1912.

Bibl.: R. IX, p. 291; XIII, p. 640; Bull. 38, p. 156.

Jursch Quarry (formerly *Carver*), Mrs. Lovella Priest, Sacramento, owner. This quarry, about 1¼ miles northeast from St. Helena, has been idle several years. The stone is trachytic tuff.

Bibl.: Bull. 38, p. 156.

Lenz Quarry, S. Lenz, St. Helena, owner. It is on the Calistoga road, 2 miles north of St. Helena post office. The rock is basalt, and paving blocks have been made there in the past. It is proposed to put in a crushing plant of 80 cubic yards daily capacity to utilize the spalls and waste from block operations for road work.

Linscott Quarry, L. C. Martin, Calistoga, owner. This quarry, 2 miles southeast of Calistoga, on the St. Helena road, has been idle for about 10 years. The stone is trachytic tuff.

Bibl.: Bull. 38, p. 156.

Manuel Quarry (see *Newman*).

Mee Ranch. A little stone (tuff) has been taken recently from the Mee ranch, 2½ miles from St. Helena on the east side near the creamery.

Moffatt Quarry, Moffatt Estate, owner; B. Bruck, St. Helena, superintendent. It is 2 miles northwest from St. Helena, and has not been worked for several years.

Bibl.: Bull. 38, p. 156.

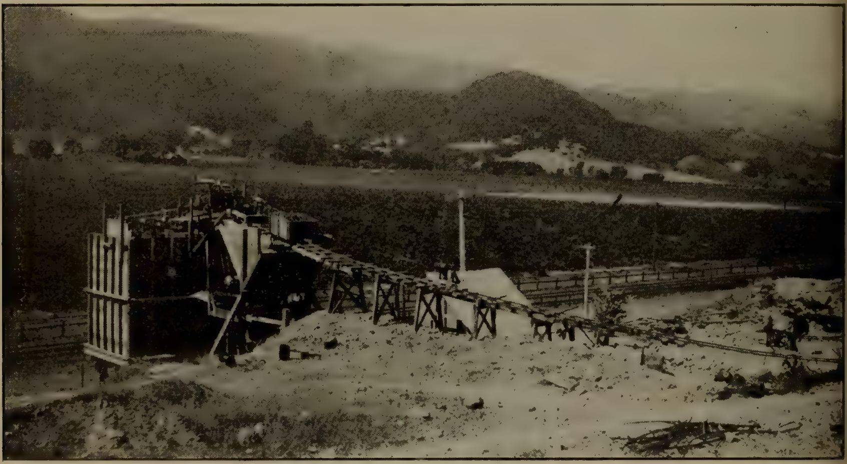


Photo No. 33. Crusher and bins at Napa County Rock Plant, near Yountville.

Napa County Rock Plant. The county owns 3 acres on the hill at the turn of the county road 1 mile northwest from Yountville. The crushing and screening plant is driven by a 20 horsepower electric motor, power being bought from the Napa Valley Electric Railway, whose tracks as well as those of the Southern Pacific Company, are within 100 feet distant (see photo No. 33). The quarry was opened up about 1909, and is worked principally during the summer months. The capacity of the plant is 100 cubic yards per day, and requires 15 men when in full operation. The rock is a somewhat decomposed volcanic. The product is used for road metal in the surrounding district, and is hauled from the plant in wide-tired, bottom-dump wagons holding 6 cubic yards each. These wagons are owned by the county, which pays 50 cents to 65 cents per cubic yard, according to distance, for the hauling, horses being furnished by the drivers. The total cost s stated to be about $1 per cubic yard of rock, laid down at the point f use.

Napa Sandstone Company, J. B. Newman, Napa, owner. This sand-tone quarry, in Clark Canyon, west of Napa, was first opened up in 873. In 1901 and 1902 some stone was quarried for bridge construcion and for the Behlow Block, Napa; but none recently. It is suitable nly for rough work, and no large pieces are obtainable.

Bibl.: Bull. 38, p. 132.

Newman Quarries (see also *Wing*). J. B. Newman, Napa, owns two uarries of trachytic tuff; one, on the Berryessa road, 5 miles northeast f Napa, and the other back of the state asylum, 3 miles southeast of apa (the latter formerly known as Manuel). Both are at an elevation f about 700 feet (U. S. G. S.). The stone is only rough, quarry-ressed, as it is coarse and used only for bridges and foundation work. he quarry near the asylum has not been operated recently.

Bibl.: R. X, p. 361; XIII, p. 640; Bull. 38, p. 157.

Olsen Quarry (see *Zollner*).

Phelan Quarry. This sandstone quarry, 4 miles south of Monticello n the west side of Berryessa Valley, has been idle for several years.

Bibl.: Bull. 38, p. 132.

Pickett Quarry, C. N. Pickett, Calistoga, owner. No stone (tuff) as been taken from this quarry for about 10 years past. It is 1¼ iles east of Calistoga.

Bibl.: Bull. 38, p. 157.

Rose Quarry, D. C. Willis, Calistoga, agent. This was originally a art of the Brown ranch. It has been idle for about ten years past. he stone is trachytic tuff.

Bibl.: Bull. 38, p. 157.

Salmina Quarry. Matilda Wilson, Napa, owner. It is 7 miles north f Napa, and has not been operated recently. The stone is trachytic uff.

Bibl.: R. XIII, p. 640; Bull. 38, p. 157.

Southern Pacific Company Gravel Pit. The Southern Pacific Raiload Company has six acres in the creek bed at the south end of Main treet, St. Helena, and adjoining the Watt gravel pit. A spur track connects with the main line. The material is utilized for ballast, but none was taken out during the year 1913.

Tychson Quarry. Mrs. J. Tychson, St. Helena, owner. On the Tychson place, 2 miles northwest of St. Helena on the Calistoga road, a paving-block quarry was opened up in 1911. The rock is a fine-grained, bluish basalt. The spalls and waste will be utilized for crushed rock for road work around St. Helena, under contract awarded by the county supervisors in September, 1913.

Watt Gravel Pit. Miss Margaret Watt, St. Helena, owner. About eight acres of this property at the south end of Main street, St. Helena, is in the creek bed and available for recovery of gravel. The balance is in orchard. Operations were begun in 1908, and the excavations show the gravel bed to be 6 to 10 feet in depth to the clay below. The major portion of the material sold is taken for ballast by the Napa Valley Electric Railway, which has a spur track into the pit. It is also used locally for street and road work. Those taking out the gravel employ their own labor, and pay a certain price per wagon or car load for the gravel removed.

Williams. There is a small quarry on the Williams place north of Calistoga.

Wing Quarry (*Newman*). H. W. Wing, Napa, owner. The Wing and the Newman quarries, adjoining, on the Berryessa road about 6 miles northeast of Napa, were originally one, owned by Newman & Wing. This quarry was first opened up in 1878. Elevation, 600 feet. The stone is a light, yellowish to gray, trachytic tuff, showing flow structure, so that, at a little distance, in part it resembles bedded sandstone strata. The stone here is of better quality, harder and more compact than the average of the tuff used in Napa County for buildings and bridges. The "Little Trancas" (Milliken Creek, U. S. G. S.) and the "Big Trancas" (Napa River, U. S. G. S.) bridges, north of Napa City were constructed of stone from the Wing quarry, the latter of which was just being finished when visited in September, 1913 (see photos Nos. 35 and 43). This bridge required 75,000 cubic feet of stone, and the average cost was stated to be 27 cents per cubic foot as laid in cement mortar.

Bibl.: R. XIII, p. 640; Bull. 38, p. 158.

Zollner Quarry (formerly *Olsen*). Estate of J. F. Zollner, owner. It is 2¾ miles south of Napa, and has both basalt and a hard gray trachyte, the former of which has been utilized for paving blocks. Idle in 1913.

Bibl.: R. XIII, p. 633; Bull. 38, pp. 158, 320, 342.

In addition to the above quarries, the following occurrences of stone have been noted, though as yet they are undeveloped:

There is *sandstone* in Maxwell Canyon, Pope Valley, 15 miles north of Rutherford, on the Maxwell and Hardin ranches; also in Gordon Valley, 11 miles east of Napa.

There is columnar *basalt* in Clark's Canyon, 12 miles west of Napa, Charles Clark, Napa, owner; also on the east slope of Mt. St. Helena, 6 miles west of Kellogg.

There is *steatite* and *serpentine* in Chiles Valley, northeast of Rutherford. There is a specimen of steatite (soapstone) in the museum of the State Mining Bureau, from the Fir Hill ranch, 2 miles west of Chiles post office.

About ½ mile west of the Corona quicksilver mine, northeast of Calistoga, is a body of light colored volcanic tuff, some of which was quarried for building purposes at the Corona. It did not weather well, as it was too soft.

Bibl.: R. V, p. 107; XII, p. 399; XIII, pp. 612, 639; Bull. 38, p. 131.

VOLCANIC ASH.

Under the name of ''Callustro,'' and sold for use as a polishing powder, a deposit of volcanic ash about 3 miles west of Calistoga was exploited some years ago. There was a small mill on the property, for grinding and screening the material, but it has been idle since 1898. W. C. Sharpstein is the present owner.

Bibl.: R. X, p. 362.

SOLANO COUNTY.

Field Work in September, 1913.

Solano, one of the "north of the bay" counties, is surrounded by Yolo County on the north, on the east Yolo and Sacramento, on the south Sacramento and Contra Costa, and on the west by Napa. San Pablo and Suisun bays and the Sacramento River are on its south, the latter forming also a portion of its eastern boundary, while Putah Creek defines a part of the northern line. The total area of the county is 900 square miles, of which 822 square miles represents the land surface. It is about 35 miles north and south by 45 miles extreme width east and west. The main drainage system of the county is tributary to the Sacramento River, and a portion to the bays. Only the western section of the county has contributed to its mineral output, as Solano's principal resources are agricultural. Her mineral products in the order of their production to date are: cement, stone industry, quicksilver, mineral water, lime and limestone, brick, natural gas, salt and fuller's earth. Solano first entered the producing column in 1860 with a natural hydraulic cement from Benicia, followed in 1873 by the operation of the St. Johns quicksilver mine, which remained an important factor for seven years. By far the most important development, however, has been the most recent one, *i. e.*, Portland cement, which began in 1900.

As will be noted from the table, the total production for the county, to the end of 1913, has been $17,205,665.

ARAGONITE (see Onyx Marble).

BITUMINOUS ROCK.

(See Vulcan Rock Quarry under Stone Industry).

BRICK AND CLAY.

High Fire-Pressed Brick Company (see Houze).

Houze Brick and Cement Company. This property, which has been variously known under the names of: High Fire Pressed Brick Company, Pressed Brick and Supply Company, Vallejo Hydraulic Pressed Brick Company, and the Houze Brick and Cement Company, is about 2 miles north of Vallejo and adjoins the Vallejo Brick and Tile Company on the south. Christian Hoffmann, of Santa Cruz, is the present owner. Its area is 52 acres, and the plant includes a Hoffmann furnace of 10,000 per day capacity. It has been idle since 1909.

Bibl.: R. XIII, p. 619; Bull. 38, p. 258.

Vallejo Brick and Tile Company, Consolidated. J. F. C. Hagens, 343 Sansome street, San Francisco, manager. This plant is 2 miles north of

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SOLANO COUNTY—Table of Mineral Production.

Year	Quicksilver		Mineral water		Lime and limestone		Stone industry. Value	Natural gas. Value	Miscellaneous and unapportioned	
	Flasks	Value	Gallons	Value	Tons	Value			Kind	Value
1873	1,800	$144,594								
1874	1,900	199,842								
1875	2,100	176,715								
1876	1,683	74,052								
1877	1,463	54,570								
1878	802	26,386								
1879	1,290	38,507								
1880	492	15,252								
1881										
1882										
1883										
1884										
1885										
1886										
1887										
1888										
1889										
1890										
1891										
1892										
1893										
1894					6,400	$8,000	$225			
1895					4,300	4,635	19,650			
1896			3,094	$1,547	5,477	5,989	15,752		75 tons pottery	$125
1897					9,608	9,801	20,975		400 tons pottery	500
1898					6,125	5,570	15,065			
1899			20,000	4,000		356	12,581			
1900			20,000	4,000	1,800	1,800	18,900			
1901			17,800	4,450		5,950	2,200			
1902	42	1,890	10,000	4,000			14,250		75,000 barrels cement	150,000
1903	100	4,100	10,000	4,000			21,514		250,000 barrels cement	375,000
1904	*377	15,080	10,000	4,000			11,113			
1905	542	18,518	10,000	4,000	100,000	100,000	78,573			
1906	528	19,272	4,000	4,000			143,487			
1907	640	24,422	40,000	4,000			202,146	$6,584	125 tons salt	600
									3,000 M brick	25,000
1908	764	33,294	140,000	11,600			527,319	8,053	400 tons salt	2,800
									1,000 M brick	7,000
1909			32,650	5,490			176,813	7,538	100 tons salt	200
									1,600 M brick	20,000
									5,600 tons clay	11,200
1910			32,400	3,960			241,949	9,100	50 tons salt	150
1911			30,000	4,000			181,952	8,596	100 tons salt	300
									500 M brick	4,000
1912			285,050	44,000			130,445	8,528	50 tons salt	100
									2,200 M brick	20,000
1913			23,600	3,440			28,915	7,336	Unapportioned, 1900-1913, inclusive	13,570,019
Totals	14,523	$846,494	688,594	$110,487		$142,101	$1,863,824	$55,765		$14,186,994

*Flasks of 75 pounds since June, 1904; 76½ pounds previously.

Totals.

Quicksilver	$846,494
Mineral water	110,487
Lime and limestone	142,101
Stone industry	1,863,824
Natural gas	55,765
Miscellaneous and unapportioned	14,186,994
Total to end of 1913	$17,205,665

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west from Vallejo post office, at tide water on the north waterfront. Rail connections are 2 miles distant. Operations began in 1909, and except for four months in winter were continuous up to the latter part of September, 1913, when the plant was closed as the result of a combination of circumstances, the principal ones being lack of water and labor difficulties. Water was obtained from the Vallejo city mains and cost $75 to $100 per month. The equipment includes one 16-chamber kiln (40,000 capacity per chamber; heated at four corners of each chamber; down-draft, oil fired); one round down-draft kiln 30 feet diameter; two dry pans (capacity 25,000 per day each); one pug mill; one brick machine; one automatic cutting table (capacity 50,000 per nine hours); two represses; one dry press (20,000 capacity per day). Steam power used with oil as fuel.

Photo No. 62. Pacific Portland Cement Company, Cement, Solano County. General view from south of old and new mills.

The following analysis of yellow shale from the company's clay beds was made by J. F. Pfleuger & Company, Bremen, Germany:

Loss on ignition (moisture and carbonic acid)	8.03%
Silica	57.83%
Alumina	19.52%
Iron oxides	7.46%
Calcium oxides	1.24%
Magnesium oxides	2.06%
Alkalies (balance)	3.86%
	100.00%

Trial runs have shown that a good vitrified brick for paving purposes can be made from this shale.

In addition to the above named plants there were at one time two others: McKenzy & Reid's pottery at Benicia, which used clay from Ione (Amador County) and from Hoyt's farm near Goodyear Station; and the Union Pressed Brick and Terra Cotta Company, with six kilns at Vallejo. These have both been abandoned for a number of years.

Bibl.: R. VIII, p. 631; XIII, p. 619; Bull. 38, p. 258.

CEMENT.

Benicia Works. This property, at Benicia, owned by Jas. Clyne, has not been operated of recent years, but previous to the rise of the Portland cement industry in California was an important producer. The product is a "hydraulic limestone" or natural cement and was first put on the market in 1860.

Photo No. 63. Orange-peel bucket excavator in quarry of Pacific Portland Cement Company, Solano County.

Bibl.: R. VIII, p. 632; IX, p. 309; XII, p. 380; XIII, p. 612; Bull. 38, p. 185; Min. Res. W. of Rocky Mts., 1868, p. 245; Geol. Surv. of Cal., Geol. Vol. I, p. 101.

Pacific Portland Cement Company, Consolidated. F. G. Drum, president; F. E. Erlinc, secretary; home office, 832 Pacific Building, San Francisco. F. D. Wood, superintendent at the plant. This plant at Cement, northeast of Fairfield, is in two units, as will be noted from the photograph (No. 62), the new one being on the right, with capacities of 2500 barrels and 3500 barrels per day respectively. The older plant began operations in 1900, and was enlarged in 1903 and 1905, while the new plant has been producing since 1907.

The original source of both their limestone and clay, and from which a portion of the supply is still drawn, was the hill immediately above the works. The limestone here was a series of travertine or tufa deposits from calcareous springs, and largely superficial. They formed terraces and cascades on the southwestern slopes of the hill, similar to the terraced deposits which may be seen forming at the present time in the Yellowstone Park, Wyoming. In the quarry at the top of the hill the limestone was found more massive and to a greater depth, but over only a limited area. Fossils have been found in this travertine and also in the clay beds nearby; the latter have been identified by the Department of Palaeontology, University of California, as "*Inoceramus* cf. *Whitneyi.*" The old low-grade dumps are now being reclaimed and sent to the mill along with the fresh material from the quarry. A Hayward orange-peel excavator (photo No. 63) is used to load the material. The so-called "Suisun marble" (see under Onyx Marble) was at one time quarried from this travertine, and for a number of years previous to the establishment of cement-making here it was a source of both lime and limestone production. The remains of the old lime kiln on the Dickey ranch, part of the property, are still

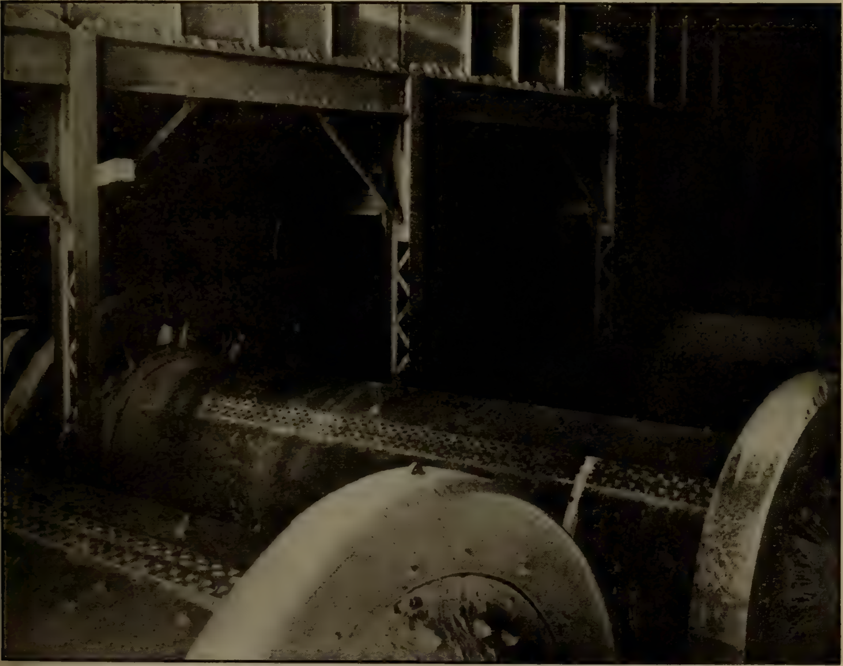


Photo No. 67. Tube mills and hoppers, for crushing raw materials in new mill of Pacific Portland Cement Company, Solano County.

to be seen. Shipments were made to the Selby smelter for fluxing purposes. It was also used as macadam. As the limestone in these deposits has diminished both in quantity and quality, the charge is sweetened by the addition of a clean lime rock from the "Great Crevice," owned by the company, at Murderer's Bar on the American River, 9 miles from Auburn, Placer County. They have their own railroad connecting the quarry with the Southern Pacific at Flint Station, and ship 1200 to 1500 tons of rock per day. The principal clay supply is at present obtained from the flat below the mills, using a steam shovel. The clay beds are 40 feet in depth. The clay layers on the hill, which stand more or less vertical, are interstratified with a shaly sandstone.

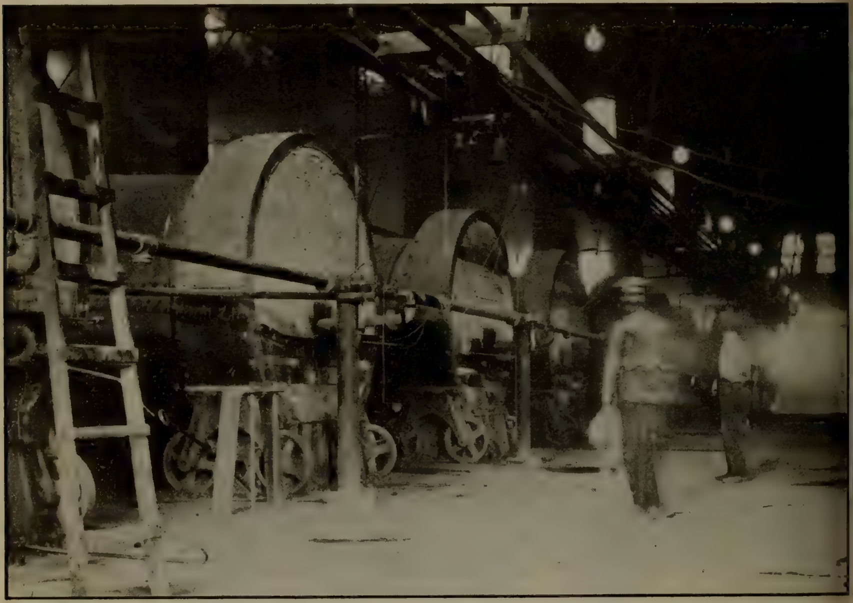


Photo No. 69. Rotary kilns in new mill of Pacific Portland Cement Company, Solano County.

In the older mill the lime rock and clay are dumped into separate bins, then weighed and carried by trolley car to the driers. The mixture is made of the coarse materials before drying. In the new plant the mixture is made with the dried ground materials between the ball and the tube mills, the limestone content being maintained at 76 per cent $CaCO_3$, before clinkering. This new unit embodies a number of improvements as compared with the older one, not only in the arrangement of the plant itself, but also in the addition and functions of new appliances and machinery.

There are cement-lined tunnels running under the mill, which contain the oil, water and sewer pipes, the power cables and some of the electrical machinery. This makes them easy of access and also free from the excessive dust of the plant.

Just above the mill there are eighteen circular steel bins holding about 100 tons each, which are used for limestone and clay storage. Each bin is sampled so that the quality of its contents is known before being drawn off into the mill. Following the ball mills are eight Berquist bins of 100 tons capacity each—four each for lime and clay—which are used for a reserve before the mix. The materials are automatically weighed and dumped into a double-screw mixing machine, delivering to an elevator which serves the individual bins for the tube-mill feed.

Photo No. 72. Solano County Jail at Fairfield. Built with "Golden Gate" cement.

The tube mills are 5′ 6″ x 22′, trunnion type (see photo No. 67). Photo No. 69 shows the discharge and fire-box end of a battery of rotary kilns in the new unit. They are using for kiln linings a brick made up of clinker and cement with a small percentage of fire clay. A temperature of 2700° F. is attained in the kilns. They are set on a grade of $\frac{3}{4}$-inch per foot. Crude oil, topped, of 16° B. gravity and 17,000 B. T. U. is used for fuel at the rotary kilns. The oil is shipped in barges via Suisun Slough to Fairfield, whence it is pumped to a tank on the hill above the plant at Cement, a distance of about 5 miles.

The discharged clinker is sprayed with water and handled by McCaslin conveyors to the rotary coolers. These coolers are like an open-ended tube mill, with longitudinal baffle plates, and a current of cold air is drawn through them. When sending the clinker to the storage pile in place of the ball mills, instead of going to the rotary coolers it is put through cooling towers similar to those described in the plant of the Standard Portland Cement Company at Napa Junction (see under Napa County). Gypsum, 2 to 2½ per cent, is added to the clinker before grinding. The tube mills designedly do not grind the product in a single stage to its desired ultimate fineness. The discharge goes to an "Emerick Air Separator." This consists of a series of horizontal revolving discs, from which the fines are drawn up by suction to the stock house, and the coarse particles which work to the periphery of the discs are returned to the mills.

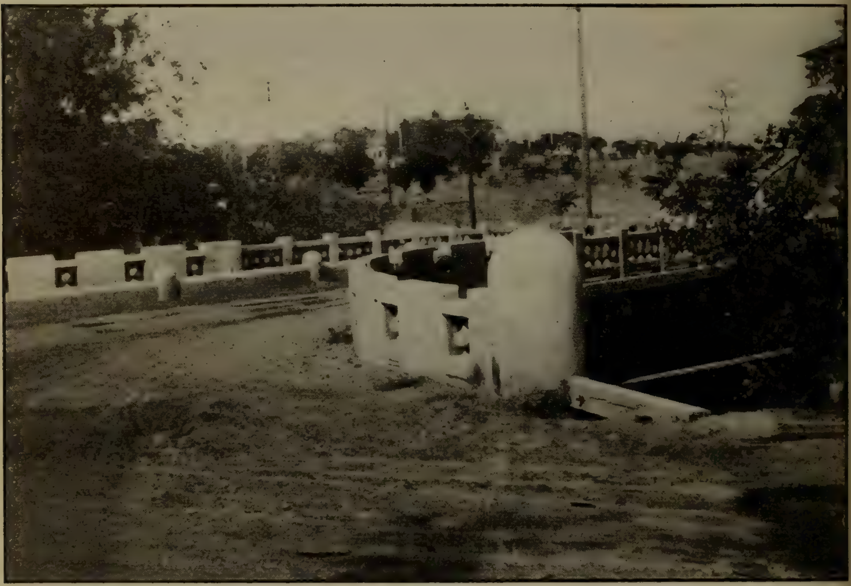


Photo No. 76. Concrete Bridge at Vacaville, Solano County (1911).

In the stock house automatic sacking machines are used and a belt conveyor takes the filled sacks of "Golden Gate Brand" cement to the waiting railroad cars alongside. The Solano County jail at Fairfield (see photo No. 72) is of reinforced concrete, in which Golden Gate cement was used. The Cement, Tolenas and Tidewater Railroad, owned by the company, connects Cement with Tolenas Station on the main line of the Southern Pacific, 2 miles to the south.

A large and well equipped laboratory is maintained for chemical analyses and physical testing. It is supplied with natural gas from the well of the Rochester Oil Company, 5 miles southeast of Cement. Included in the equipment of the two mills are 250 electric motors, varying from 580 h.p. down to 1 h.p., and there are eight 6′ x 60′, eleven 7′ x 80′, and one 8′ x 100′ rotary kilns. From 6000 to 7000 h.p. per day are consumed, and about 500 men are employed. The water supply comes from wells—one at the works and others at Vacaville, where the company has a pumping plant.

(For a more detailed description of the general process of cement manufacture, see Cement under Napa County.)

Bibl.: R. X, p. 670; XII, p. 395; XIII, p. 632; Bull. 38, pp. 185–189; GEOL. SURVEY OF CAL., Geol. Vol. I, p. 104; U. S. G. S., Bull. 243, p. 120; Bull. 522, pp. 118, 121.

CHROMITE.

Chromite is reported to occur near Fairfield. There is a specimen n the museum of the State Mining Bureau, said to have come from that locality, but the deposit is undeveloped.

Bibl.: R. IV, p. 137; VI, Pt. I, p. 101; VIII, p. 632; Bull. 38, p. 363.

COAL.

Lignite is reported as occurring in the southwestern part of the county, but no development work has been done.

Bibl.: R. VI, Pt. I, p. 118; VII, p. 151; GEOL. SURV. OF CAL., Geol. Vol. I, p. 106.

FULLER'S EARTH.

Western Fuller's Earth Company (Joice ranch). This is on the Joice ranch, ½ mile northeast from the railroad station at Vacaville. Mrs. Clara I. Hopkins, Fairfield, and the Joice Estate, owners. The deposit consists of a series of bedded strata in a low rounded ridge about ½ mile in length, strike northwest and dip about 40° E. Elevation 200 feet (U. S. G. S.). The open cut has exposed these strata for a thickness of over 30 feet. The color varies from white to light brown. There is no plant, the material being simply sacked as broken out, and shipped.

The typical fuller's earth is a non-plastic clay, which falls to pieces easily in water, and which has a strong affinity for grease in cloth and coloring matter in oils. While it is now well understood that chemical analyses are no criterion in determining whether or not a particular clay should be classified as "fuller's earth," this Vacaville material is not a clay, but "Monterey shale." It has a slight clay odor and adheres to the tongue, but does not break down readily in water. Under the microscope it is seen to be a fine, angular volcanic ash, with an occasional circular diatom. But the practical test is a physical one—whether or not it will do the work of a fuller's earth. The Vacaville earth answers this specification. Charles L. Parsons (U. S. Bureau of Mines, Bull. 71, Mineral Technology No. 3, on "Fuller's Earth," 1913, p. 24), in a table giving "Bleaching Tests of Fuller's Earth" on cottonseed oil, indicates that the Vacaville earth gave only a slight reduction in color, and notes: "Indeed, as regards edible oils, several of these clays should not be classified as fuller's earth at all." In "Mineral Resources of the U. S., 1912," Vol. II, p. 1020, it states: "California had only two producers of fuller's earth in 1912—the Eight Oil Company at Bakersfield, and the Western Fuller's Earth Company at Vacaville. The fuller's earth in California is reported as having been used in refining animal fats and vegetable oils."

In verification of this latter statement, the packing-house of the Western Meat Company, at South San Francisco, was visited recently by the writer. This company is using a considerable tonnage of both English earth and the Vacaville variety, the latter giving nearly as good results as the standard English fuller's earth. M. J. Levy, the company's chemist, in my presence, made a comparative bleaching test on "prime summer yellow cottonsed oil," using the English and Vacaville materials (through 100-mesh screen). Identical 300-gram samples of the oil were heated to 216° F., 21 grams of the earths severally added, and agitated for three minutes, then filtered and the colors compared with the Lovibond color scale. To the unaided eye the difference in color was but slightly noticeable. The figures were as follows:

	Yellow	Red
Unbleached oil	35	6.0
Through English earth	20	2.3
Through Vacaville earth	20	2.8

The following figures are the result of a series of similar tests made by Levy, October 28, 1912 (samples through 100-mesh screen, except as noted):

	Yellow	Red
English	20	2.1
Florida	20	2.2
Vacaville	20	2.6
Vacaville (floated)	20	2.7
Bakersfield	20	3.4

In bleaching edible oils, a given charge of fuller's earth is used but once—5% to 10% of the weight of the oil to be bleached being the amount of earth taken. The oil is heated to a little above that of boiling water, the earth added and the mixture agitated three or four minutes, then filter-pressed.

With mineral oils the earth (through 15 to 80 mesh) is charged into a tall cylinder about 15 feet in height and the oil is allowed to percolate through this. The oil may or may not be heated before filtering, depending on its viscosity. A given charge of earth may be used ten to sixteen times. After blowing out the percolator with air, then washng with naphtha, and finally blowing out with steam, the fuller's earth s revivified by heating to a dull red heat in a rotary kiln similar (but smaller) to those used in Portland cement manufacture. In pursuance of experiments for a thesis in the Department of Mineralogy and Geology, University of California, in 1912, one of the students found that samples of Monterey shale, from a certain locality in Santa Cruz County, "possessed the properties of a first class fuller's earth." A sample of similar material from Pinole, Contra Costa County, gave similar results. These tests were made with mineral oil, a "heavy distillate S. G. O. 95, black in color." No mention is made of having tested samples of the Vacaville material, so it would seem worthy of nvestigation to determine its suitability for decolorizing petroleum.

Bibl.: Bull. 38, p. 273; U. S. G. S., Bull. 315, pp. 268, 290; Bull. 365 and 475; Min. Res. 1907, 1911, 1912; U. S. Bur. of Min., Bull. 71.

LIME AND LIMESTONE.

As has been noted under "Cement" the travertine deposits on the A. A. Dickey ranch, now owned by the Pacific Portland Cement Company, were at one time quarried, and the material calcined for lime. There are similar deposits, but smaller in extent, at Tolenas Springs (see under "Onyx Marble," also "Mineral Water"). The "hydraulic imestone" at Benicia has been mentioned under "Cement."

Bibl.: R. VIII, p. 631; X, pp. 669, 670; XII, p. 632; Bull. 38, p. 61.

MARBLE (see Onyx Marble).

MINERAL WATER.

Tolenas Springs. Donald Lamont et al., San Francisco, owners; H. W. Conkle, box 63, Suisun, lessee. The springs are at the head of Soda Springs Creek, 5½ miles north of Fairfield, at an elevation of 300 feet (U. S. G. S.). The following temperatures were noted: Tolenas 66° F.; spring at aragonite deposit on road below house, 76° F. There was much gas escaping from this latter spring, and it was surrounded by a considerable deposit of calcareous sinter. Water from the former is bottled for sale. It has a noticeable salty taste from the sodium chloride it carries—216 grains per gallon. The escaping gas (CO_2) is caught in a gasometer and pumped into the water in bottling. There are no accommodations for guests. There is also a white sulphur spring about ¼ mile below. Some years ago this "onyx marble," or aragonite, was quarried and sold as "Tolenas onyx," but there was too small a body of it. Some beautifully banded pieces could be obtained, but not in sufficient size. There are several of these deposits around the springs and in the near-by hills.

Bibl.: R. VI, Pt. I, p. 74, X, pp. 668, 670; XII, p. 346; XIII, p. 521; Bull. 24, p. 138; U. S. G. S., Bull. 32, p. 209; Water Sup. Pap. 338, pp. 162–163; "MINERAL SPRINGS AND HEALTH RESORTS OF CAL.," W. Anderson, p. 255.

Vallejo White Sulphur Springs (also known as White Sulphur and Vallejo Sulphur Springs). Manuel Madrid, Vallejo, owner. They are in Sec. 10, T. 3 N., R. 3 W., 5 miles northeast of Vallejo, elevation 400 feet (U. S. G. S.), at the head of Sulphur Springs Creek. The springs are at the foot of the sharp ridge of rocks known as Sulphur Springs Mountain. The main spring is stated to have an average flow of about 100,000 gallons per twenty-four hours. The temperatures are: Blue Rock, 67° F.; Small Sulphur, 69.5°, Big Sulphur, 68°. Water from the first named is bottled. There are accommodations for 100 guests.

Bibl.: R. XII, p. 347; XIII, p. 520; U. S. G. S., Bull. 32, p. 209; Water Sup. Pap. 338, p. 255; W. ANDERSON (op. cit.), p. 260.

NATURAL GAS.

Rochester Oil Company (formerly Hurley's ranch). J. R. Chadbourne, president; Geo. Trainor, secretary, Suisun. The well is on land owned by J. L. Freitas, and leased to the company, in Sec. 24, T. 5 N., R. 1 W., 8 miles north of east from Suisun and 6½ miles south of Elmira; elevation 50 feet. The well was drilled in 1901 for oil because of a seepage near-by. Gas was struck at a depth of 1520 feet. They drilled on to 1820 feet, but nothing further was obtained and the well was abandoned for three years. Four other holes were drilled without result. Salt water comes up with the gas (see under Salt). The flow of gas is stated to be about 20,000 cubic feet per day, and it is distributed by its own pressure through pipes to Suisun, Fairfield and Cement. There is a gasometer of about 20,000 cubic feet capacity at the well. We were informed by the chemist at the cement works that it is an efficient gas but contains considerable moisture.

In addition to the above, the following occurrences of natural gas are noted:

M. Allen Ranch in Sec. 2, T. 4 N., R. 1 W., used for domestic purposes by the owner.

Hilborn Bros. Well in an "anticlinal valley," in the Potrero Hills, n the northern part of T. 4 N., R. 1 W. Not utilized.

L. A. Lambrecht Ranch in Sec. 12, T. 4 N., R. 1 W., used by owner for domestic purposes. This one and the Allen well are in the marsh and at the edge of tidewater, while that of the Rochester Oil Company s on the low flat land just above the marshes.

Bibl.: R. VIII, p. 185; X. pp. 659, 660; XIII, p. 569; Bull 3, p. 5.

ONYX MARBLE.

Under the name of "Suisun marble" some stone was at one time quarried from the travertine deposits on the Dickey ranch, now owned by the Pacific Portland Cement Company, near Suisun. Some pieces showing a beautifully banded and wavy structure were obtained, but for the most part stone of only small dimension could be cut out. The same thing is true of the deposits at the Tolenas Springs, 4 miles west of these. Aragonite has also been found at Vacaville.

Bibl.: R. I, p. 17; IV, p. 73; V, p. 67; VI, Pt. I, pp. 22, 91; VIII, p. 631; X, pp. 668–670; XII, p. 403; XIII, pp. 632, 641; Bull. 37, p. 112; Bull. 38, p. 114; GEOL. SURV. OF CAL., Geol. Vol. 1, p. 104; U. S. G. S., Water Sup. Pap. 338, p. 162.

PETROLEUM.

Midas Petroleum Company, C. J. Reeves, secretary; home office, Call Building, San Francisco. This company is drilling for oil on the Ryerson ranch above Glen Cove, southeast of Vallejo. The company has a well equipped plant and drill rig and were down over 300 feet in September, 1913, expecting to go to 2000 feet depth. They claim to have obtained favorable indications and some oil seepage.

Rochester Oil Company (see under Natural Gas).

Vallejo and Napa Gas and Oil Company. Mrs. Jennie Hartzell, president; Wallace Rutherford, Napa, attorney and director. The company has 20 acres back of the cemetery north of Vallejo, where they propose to drill for oil.

QUICKSILVER.

St. John's Mines Company (formerly St. John's Consolidated Quicksilver Mining Company). Clifford B. Dennis, Vallejo, manager, C. F. Colmar, Alaska Commercial Building, San Francisco, secretary. The surface rights are owned by C. M. Wilson, of Los Angeles. The St. John's mine is in Sec. 33, T. 4 N., R. 3 W., 6 miles northeast from Vallejo, with an excellent oiled road to within 1 mile of the furnaces. It is at the northern end of the ridge called Sulphur Springs

Mountain. Its first period of operation was 1873–1880, when it produced a total of 11,530 flasks. The St. John's Consolidated Company reopened the mine in 1899 and continued production up to 1909, since which time only a small amount of development work and occasional retimbering to keep the mine open has been done. Total production to date has been 14,523 flasks of quicksilver.

The country rocks are an indurated shale and metamorphic sandstone, the latter of which is in part quartzite. The ore carries cinnabar with pyrite, marcasite and some quartz, which has been deposited principally along the fissure planes and jointages in both the sandstone and schist. Cinnabar also occurs as an impregnation in the sandstone, resembling the ore of the Oat Hill mine, Napa County, except that here it is harder. A thick, dark brown mineral oil which burns readily when a candle is applied to it, is found in the jointages and fissures in and near the ore bodies.

The shaft is down 400 feet, reaching a depth of about 650 feet vertical, below the outcrop. There are three main levels from the shaft and five intermediates. The main adit is above the furnace level, connecting with the shaft at the 300, and is in over 1100 feet. There are six main stopes in the work of later years, the largest of which is 250 feet long by 20 feet wide and 20 feet high, extending diagonally down through three levels. There are two coarse ore furnaces of 20 tons capacity, and one 24-pipe retort, the former of which it is proposed to replace by a fine-ore furnace with larger capacity.

Since the mine was visited (September, 1913), the newly organized company noted above has taken over the rights and equities of the older company under an option to purchase. Development work will be increased and a furnace built. It is stated that experiments are being made on concentration of the cinnabar by an oil flotation process, with satisfactory results.

Bibl.: R. I, p. 26; VIII, p. 631; X, p. 661; XIII, p. 599; Bull. 20, p. 19; Bull. 27, pp. 93-97; U. S. G. S. Mon. XIII, p. 378; An. Rep. XXI, Pt. VI, p. 278; Min. Res. 1907, 1908, 1909, 1910, 1911, 1912; MIN. RES. WEST OF ROCKY MTS., 1874, p. 20; 1875, pp. 14, 178; 1876, p. 20. MINING AND SCIENTIFIC PRESS, Vol. 109, p. 585.

SALT.

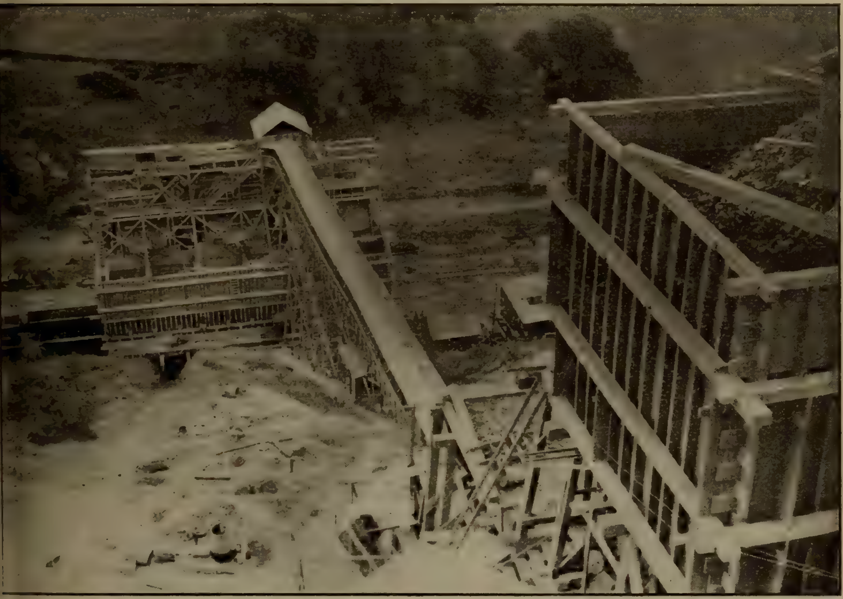
Rochester Oil Company (see also under Natural Gas). J. R. Chadbourne, president, Geo. Trainor, secretary, Suisun. The company has a natural gas well in Sec. 24, T. 5 N., R. 1 W., 8 miles north of east from Suisun. Salt water flows from the well with the gas, and is run out into a shallow basin of about 10 acres in extent and dried by solar evaporation. The basin has a hard-pan bottom and the brine s run in to a depth of 4 to 5 feet in the spring, the salt being gathered n August or September. The excess brine is piped to the slough. fter evaporation the top material is thrown up with forks, then hauled n wagons to the bank, where it is piled in cones and afterward sacked. o refining is done. It is sold at $3 per ton at the well, principally or stock salt, pickling, etc.

STONE INDUSTRY.

Benicia Rock Crushing Company (see Vulcan Rock Company).

Cordelia Quarry (see Thomasson).

County Macadam Quarry. F. A. Steiger, Vacaville, owner. It is mile north of Vacaville, and the county at one time obtained crushed ock here for road work, but it has been idle for several years. The ock is basalt. It is stated that there is another and larger body of asalt a short distance north of this one, on the Garnet ranch, but unde-eloped.



hoto No. 58. Rock Crushing Plant of E. B. & A. L. Stone Company, at Thomasson ("Cordelia" Quarry), Solano County.

McNaughton's Quarry (see Thomasson).

Thomasson Quarry (known locally as the "Cordelia" quarry, also ormerly as McNaughton's). E. B. & A. L. Stone Company, owner. B. Stone, president, R. P. McDonald, secretary, 401 Phelan uilding, San Francisco; T. Griffiths, superintendent at the plant. he quarry is in an isolated hill of basalt at the edge of the marsh land 1 mile east from Cordelia. It is connected by a spur track wit the Southern Pacific Railroad at Thomasson Station. The quarry wa first opened up about 1875, and for about twenty years produce principally paving blocks, for which the rock is well suited, being a compact, olivine basalt, dark blue to gray in color, with a straight, clea fracture. When visited (September, 1913) there were but three me making blocks, as the market for such is dull, nearly all of the outpu being as crushed rock for road metal, concrete, etc.

Near the surface the basalt shows in the form of rounded boulder the result of concentric decomposition. Lower down it is more massiv but oxidized to yellow and gray along fracture planes. In one part o the quarry the stone exhibits the hexagonal jointing (vertical here common in basaltic masses. In places a vesicular structure is encountered, and at the south end of the hill there is a tuff.

The plant (photo No. 58) is equipped for a daily capacity of abou 1000 tons, but the output varies according to the demands of the marke and the supply of labor. The product is classified into four sizes b revolving screens. Waste material and dust is taken out through tunnel below and utilized by the railroad for filling and ballast. Th quarrying is done by contract at 25 cents per ton and an output o about 10 tons per man per day is made. Ten quarry faces are a present worked. Electric power is used throughout the plant, th equipment of which includes six motors (200 h.p. largest), one No. two No. 5, one No. 4, and three No. 2 gyratory crushers. Conveye belts and bucket elevators are used, and there are 12 bunkers with total capacity of 2000 tons.

The following is the result of a test on road material from thi quarry by the Division of Tests, U. S. Department of Agricultur Bureau of Chemistry, dated February 28, 1905:

Material: Olivine basalt.

Specific gravity	2.78
Weight per cubic foot	174.64 pounds
Water absorbed per cubic foot	0.93 pounds
Per cent of wear	2.27
French coefficient of wear	17.65
Hardness	17.5
Toughness	30
Cementing value	14 dry; 214 wet

"REMARKS—This rock has a fair cementing value when tested dry, but develo a very high value when ground wet. This indicates that plenty of water shou be used under the roller when laying the upper course. The resistance to wear good and the rock should make an excellent road material."

Bibl.: R. X, p. 659; XII, p. 390; XIII, pp. 627, 634; Bull. 3 pp. 325, 342.

P. Siebe has a small quarry opening opposite the station at Cordelia, om which a light-colored tuff has been taken for road dressing, but has not been worked recently.

Bibl.: Bull. 38, p. 326.

Southern Pacific Railroad Company. The railroad company has a ıarry for rock ballast about 3 miles north of Benicia. Worked interittently.

Vulcan Rock Company (formerly Benicia Rock Crushing Company, so Benicia Crushed Stone Company). Geo. U. Hind, president. ome office, 153 Sutter street, San Francisco. E. F. Rogers, Benicia, perintendent. The company has the quarry rights on the ranch of H. Hoyt, 7 miles northeast of Benicia. The shipping point is Hoyt ling, at the crusher, 1 mile north of Goodyear Station on the ›uthern Pacific. The quarry is on the edge of the range of hills hich borders the west side of the Suisun marsh. The rock varies om a blue-black, fine grained basalt, with an occasional feldspar ıenocryst, to a tuff. There is some vesicular material, in part oxized to red. Compressed air drills are used and the rock is hauled horse-drawn trains to the crusher, which has a daily capacity of 0 tons. Electric power is used, and the product is screened into ur sizes: "screenings," to 2½ inches. The waste is run to dumps. ost of the output is used for macadam, but some for concrete. Fifen to thirty-five men are employed, varying with the demand. This ıarry was at one time reported to be producing "bituminous" rock, ıt the deposit is not bituminous.

Bibl.: R. X, p. 669; XII, p. 390; XIII, p. 627; Bull. 38, p. 325.

In addition to the above there are two small quarries of *tuff* in the ›rthwest corner of the county, owned by Sacket Bros., of Winters, ıd by D. L. Tucker et al., Winters, respectively. The former extends ross Putah Creek north into Yolo County. Also two small *sandstone* ıarries northwest of Vacaville, owned by F. Frietas and F. B. ington, respectively. No stone has been taken from these quarries recent years.

Bibl.: R. X. p. 791; Bull. 38, pp. 141, 162.

SONOMA COUNTY.

Field Work in October and November, 1913.

INTRODUCTION.

Sonoma County is both a coast county and one of the "North the Bay" group; being bounded on the west by the Pacific Oce and Marin County, on the north by Mendocino, on the east by La and Napa, and on the south by San Pablo Bay. It has a land ar of 1577 square miles. The drainage of the northern two thirds the county is to the Pacific Ocean, principally by the Russian Riv and its branches; while the southern end drains to San Pablo Ba through Petaluma and Sonoma creeks. Though part of two separa drainage areas, the main valley through the center of the county some 60 miles north and south by about 25 miles wide.

The mineral resources of Sonoma County are quite varied, as w be noted by the Table of Mineral Production. In the order of th value to date they are: Stone industry, quicksilver, brick and cl products, mineral water, mineral paint, magnesite, graphite, lime, ge and infusorial earth. Their total recorded production to date, h been approximately $7,600,000. The actual output must certainly ha been considerably in excess of this, as there are no figures for sto industry earlier than 1887, though paving blocks have been ma in Sonoma County since 1864 (Tenth Census Report, Vol. X, Pt. p. 97); nor are there any figures for bricks earlier than 1887, r for mineral water earlier than 1895. Though in this latter case so of the springs are known to have reported sales for at least ten ye previously, the figures are not available.

In addition to the minerals above noted as produced in commerc quantities, occurrences of the following have been found: Chro coal, copper, gold, iron, manganese, silicified wood, onyx marble, garn and sulphur.

ABRASIVES (see Garnets under Gems).

BRICK AND CLAY.

Beltane Clay (see Weise Clay Pit).

California Brick and Pottery Company. This plant at Glen Ell now partly dismantled, has not been operated for some four ye past. C. Hidecker et al., of San Francisco, were operators. Comn bricks burned in field kilns were first made, followed by the ma facture of hollow, building tile. For this latter, it is stated that ab one third of their raw material was obtained from Ione, Ama

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SONOMA COUNTY—Table of Mineral Production.

Year	Quicksilver		Mineral paint		Bricks		Mineral water		Stone industry, Value	Magnesite		Miscellaneous and unapportioned	
	Flasks	Value	Tons	Value	1,000	Value	Gallons	Value		Tons	Value	Kind	Value
1873	50	$4,017	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1874	1,700	178,806	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1875	1,218	102,495	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1876	3,897	171,468	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1877	3,609	134,616	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1878	3,255	106,890	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1879	2,977	88,923	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1880	1,445	44,795	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1881	1,273	37,974	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1882	2,124	59,960	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1883	1,669	47,984	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1884	332	10,126	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1885	446	13,715	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1886	735	26,093	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1887	689	29,196	-----	-----	1,000	$5,000	-----	-----	$350,000	-----	-----	-----	-----
1888	1,151	48,918	-----	-----	1,000	5,000	-----	-----	367,500	-----	-----	-----	-----
1889	1,345	60,525	-----	-----	-----	-----	-----	-----	[3]297,236	-----	-----	-----	-----
1890	1,046	54,915	-----	-----	-----	-----	-----	-----	[1]245,000	-----	-----	-----	-----
1891	1,660	75,115	-----	-----	-----	-----	-----	-----	[1]150,000	-----	-----	-----	-----
1892	1,630	66,357	-----	-----	-----	-----	-----	-----	96,000	-----	-----	-----	-----
1893	1,445	53,104	-----	-----	-----	-----	-----	-----	92,800	-----	-----	-----	-----
1894	1,368	41,998	100	$3,500	375	1,875	-----	-----	57,381	-----	-----	-----	-----
1895	1,813	70,707	225	3,375	350	1,750	8,000	$32,500	69,508	-----	-----	-----	-----
1896	1,126	37,150	220	3,740	250	1,250	14,400	19,287	73,719	-----	-----	-----	-----
1897	1,538	59,982	270	3,780	[1]300	1,500	236,000	24,000	33,035	-----	-----	-----	-----
1898	1,704	63,048	-----	-----	350	2,800	246,680	23,490	43,371	-----	-----	-----	-----
1899	2,119	105,950	-----	-----	200	1,800	21,000	18,500	16,830	-----	-----	-----	-----
1900	2,209	99,500	-----	-----	280	2,360	575,000	35,000	20,275	-----	-----	-----	-----
1901	2,130	95,850	-----	-----	150	1,200	60,900	17,691	52,701	175	$1,225	64 tons graphite	$4,460
1902	1,440	64,685	30	105	150	1,200	30,000	9,100	121,578	130	455	42 tons graphite	1,680
1903	2,404	98,676	800	320	160	1,440	10,000	4,000	90,933	-----	-----	-----	-----
1904	[2]2,700	102,829	-----	-----	175	1,750	11,000	4,400	75,947	-----	-----	1,500 barrels lime	2,250
1905	2,584	97,041	-----	-----	500	4,000	10,000	4,000	213,830	-----	-----	-----	-----
1906	2,070	75,555	-----	-----	6,800	115,000	10,000	4,000	158,218	-----	-----	Gems	300
1907	560	21,369	-----	-----	11,600	133,479	12,000	4,200	132,946	250	1,250	1,500 barrels lime Gems 10,500 tons clay	2,600 50 10,700
1908	590	24,939	-----	-----	11,000	83,000	10,000	1,000	307,695	15	180	2,600 tons clay	3,000
1909	344	14,226	-----	-----	6,500	29,000	104,000	21,350	319,716	-----	-----	500 tons clay Unapportioned 1900–1909	5,500 15,000
1910	260	11,765	-----	-----	-----	-----	235,000	50,350	220,998	-----	-----	-----	-----
1911	94	4,325	-----	-----	-----	-----	202,500	50,250	184,035	-----	-----	Unapportioned	1,000
1912	646	27,158	-----	-----	-----	-----	62,500	20,950	295,198	300	3,000	-----	-----
1913	12	483	-----	-----	-----	-----	96,240	46,910	191,436	-----	-----	-----	-----
Totals	61,407	$2,533,228	1,645	$14,820	41,140	$393,404	1,955,220	$390,978	$4,277,886	870	$6,110	-----	$46,540

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[1] Estimated.
[2] Flasks of 75 pounds since June, 1904. Previously 76½ pounds.
[3] Eleventh Census Report, Vol. X, Part 3, p. 605.

Totals.

Quicksilver	$2,533,228
Mineral paint	14,820
Brick	393,404
Mineral water	390,978
Stone industry	4,277,886
Magnesite	6,110
Miscellaneous and unapportioned	46,540
Total to end of 1913	$7,662,966

ounty. Steam drying sheds were used. There are five circular brick d pottery kilns (see photo No. 135), which were oil fired.

Bibl.: R. XII, p. 384; Bull. 38, p. 258.

Healdsburg Brick Company. W. Burgett, Healdsburg, owner. Idle nce 1906.

Bibl.: Bull. 38, p. 258.

James Henderson on his ranch near Glen Ellen is stated to have nall deposits of high grade pottery clay, but they are not utilized.

Pure Clay Brick and Tile Company (formerly Hilton Brick Co.). H. Stack et al., 103 Main street, San Francisco, owners. This plant at Hilton near Guerneville, on the Russian River. No bricks have en burned here since 1912.

oto No. 135. Circular Brick Kilns of California Brick and Pottery Company, Glen Ellen, Sonoma County.

Bibl.: R. VIII, p. 635; Bull. 38, p. 258.

At Skaggs Springs there is a deposit of yellow clay, which is stated be suitable for terra cotta. Peter J. Curtis, owner.

Weise Clay Pit (also known as Beltane Clay). J. H. Weise, Glen len, owner; J. T. Stanton, 315 Merchants National Bank Building, n Francisco, lessee. This deposit of white kaolin is in a hill about mile northeast of Beltane station, between Glen Ellen and Kenwood.

It is a high grade aluminum silicate, as will be noted from the analyses It appears to have been originally a fine grained acid volcanic material which has been very thoroughly kaolinized. In the lower part of th deposit, which has been opened up by several short tunnels, the kaoli is soft and has a greasy feel; while at the top of the hill it has bee hardened by a subsequent infiltration of silica.

A considerable tonnage of this siliceous material has been employe by the Gladding, McBean Company, mixed with their Amador Count clay in the manufacture of fire brick. The Beltane clay is stated t decrease the shrinkage. The Santa Cruz Portland Cement Compan has been using the softer material from the lower levels in the preparation of a special white cement for decorative and statuary work. Th fusion point of this clay is said to be very high—about 4500° F.

Analysis of "Beltane clay" by Smith, Emery & Company, Chemists, San Francisc

	No. 1 (hard)	No. 2 (medium)	No. 3 (soft)
SiO_2	74.60%	56.29%	58.10
Al_2O_3	15.97%	31.13%	26.79
TiO_2	.21%	.31%	.56
Fe_2O_3	.50%	.59%	1.17
MnO	Trace	------------	Trace
CaO	.18%	.05%	.32
MgO	.06%	.05%	.05
Loss on ignition	8.80%	11.67%	12.66
	100.32%	100.09%	99.65

There are specimens of clay in the museum of the State Minin Bureau from Agua Caliente, Guerneville, Healdsburg, Mark Wes Springs, Santa Rosa and Sonoma, but the deposits are not at presen utilized.

CEMENT BLOCKS.

George Reilly, 300 Olive street, Santa Rosa, has a plant where h makes concrete building blocks, sewer pipe, culverts and railroad tie The equipment includes an electric motor, concrete mixer and a plane for dressing the artificial stone blocks. California cement is employe with sand and gravel from local deposits, principally from the bed Santa Rosa Creek, near by.

Mr. Reilly has recently obtained patents on a clamp for fastenin railroad rails to concrete ties, and also on a device for forming hol for new clamp anchorages in concrete or stone (*e. g.*, for placin switches, turnouts, etc.). He is placing these on the market in conne tion with his concrete ties for railroad use.

Sonoma Stone and Construction Company, Santa Rosa. Defunct.

Bibl.: Bull. 38, p. 170.

CHROME.

Chromite deposits are known at several localities in Sonoma County, t none of them are at present being utilized commercially, though a v small shipments have been made in the past. Among these occurrices may be noted the following:

Three miles west of Geyserville, south of wagon road.

At Asti Colony, three miles south of Cloverdale.

Dotta ranch near Healdsburg, Mrs. L. H. Dotta and sons, owners.

Chromite float is found along the ridge east of Healdsburg, running rth from Fitch Mountain.

Near Lytton Springs, there is also chromite.

There is a deposit of chromite near the Madeira magnesite property, miles north of Guerneville. George Madeira, Healdsburg, owner.

Sonoma Magnesite Company, adjoining on the east these magnesite posits north of Cazadero, chromite is found in T. 9 N., R. 12 W.

Bibl.: R. IV, p. 137; XIII, p. 50; U. S. G. S. Bull. 430, p. 168.

COAL.

Some small strata of coal are known at several points in Sonoma unty, but they are not utilized. Some of these are:

At the head of a gulch ¼ mile from the beach near Fort Ross.

Eight miles east of Stewart's Point on the road to Skaggs Springs.

Pierson Mine, on the Wrightson ranch, in Sec. 27, T. 8 N., R. 8 W., the road to Mark West Springs; N. E. McGrew, owner. In 1910 d 1911 some development work was done.

On the *Taylor ranch,* 2 miles south of Santa Rosa, considerable ney was spent in development work about twenty years ago. Though fair quality of coal was found, the strata were too much broken up.

Bibl.: R. VII, Pt. I, p. 118; VII, pp. 151, 190; VIII, p. 634; X, p. 676; XI, p. 259; XII, p. 61; XIII, p. 55.

COPPER.

Altamont Group, in Sec. 17, T. 7 N., R. 10 W., 2 miles southeast m Monte Rio. Small detached masses and specimens of copper re found here, and some development work done, but no definite ore ly uncovered.

Bibl.: Bull. 50, p. 167.

rcher Tract Prospect, in Sec. 30, T. 8 N., R. 10 W., east of Guernele; Geo. K. Thornton, owner. Idle.

Bibl.: Bull. 50, p. 166.

Cornucopia Copper Mining Company (formerly Squaw Creek; also known locally as the *Healdsburg Copper*), W. M. Jacobs, Healdsburg (president and manager); H. A. Jacobs, Healdsburg (secretary). This group of three claims is in Secs. 33 and 34, T. 12 N., R. 9 W., 14 miles northeast from Cloverdale. The stage road to the Geysers runs within two miles of the claims, which are reached by trail. They were first located about 1902, and the present owners have been working them since 1912.

To uncover the ore body, the surface has been ground sluiced. It is stated there are two main "veins" (85 feet and 10 feet wide, one being a brecciated zone), also a third one, smaller, and that they have been traced for ¾ of a mile on the surface. The strike is northwest and the dip northeast, nearly vertical. The country rock is much altered. The ore carries copper carbonates at the surface, with chalcopyrite below, the gangue minerals being calcite and some quartz. There is a 40-foo shaft in the canyon, and a tunnel in 315 feet. In November, 1913, two men were driving this tunnel, which was expected to cut the ore in another 50 feet at 200 feet below the outcrop.

Gray Prospect, E. F. Bean, Healdsburg, owner. It is on Devil Creek a branch of Austin Creek, north of Guerneville. Idle.

Grizzly Claim and *Healdsburg Lode*, north of Healdsburg. Idle.

Bibl.: R. V, p. 97; Bull. 50, p. 167.

Copper is also stated to have been found near *Skaggs Springs*.

Bibl.: R. V, p. 98.

Squaw Creek Copper Mines (see Cornucopia Company).

Wall Prospect. Copper indications were found at the Wall Spring Quicksilver mine, but nothing developed. H. C. Wall, Hilton, owner

Bibl.: Bull. 50, p. 166.

Ward Tract, J. W. Ward, Healdsburg, owner. Copper float ha been found on the Ward ranch in Sec. 22, T. 9 N., R. 10 W., bu nothing has been developed.

Bibl.: Bull. 50, p. 167.

DIATOMACEOUS EARTH (see Infusorial earth).

GARNETS (see under Gems).

GEMS.

Garnets, of two varieties, are found in Sonoma County. On the Co ranch, Mrs. Nate Cox, owner, 3 miles west of Healdsburg, *almandit* rnets occur abundantly in a chloritic schist. Many of them would suitable for watch jewels if they could be separated economically om the enclosing schist. Their most likely commercial utilization, wever, will probably be as an abrasive.

Grossularite occurs near Petaluma in association with copper minals.

Bibl.: R. IV, pp. 99, 182; VI, Pt. I, p. 91; Bull. 37, p. 52.

Opals, of gem quality and a fair play of ''fire,'' have been found in sociation with the kaolin deposit on the Weise ranch between Glen llen and Kenwood. Some of these have been cut and sold in San rancisco. J. H. Weise, Glen Ellen, owner.

GOLD.

Traces of gold have been found at several places in Sonoma County, t nothing of consequence ever developed.

Bibl.: R. XIII, p. 436.

GRANITE.

Through an error, production of granite from Sonoma County was ported both to this Bureau and to the United States Geological Sury, for several years. I found, on visiting the quarries, that the aterial so reported from Agua Caliente is a vitrophyre associated with achytic tuff. That classed under ''curbing'' from other parts of e county is the andesite from which most of the paving blocks are ade.

Bibl.: Bull. 38, p. 376.

GRAPHITE.

On the property of the *Healdsburg Paint Company* (see also under *ineral Paint*), southwest of Healdsburg, a deposit of graphite was covered, but it has not been developed.

Bibl.: Bull. 38, p. 281.

McPherson Ranch Deposit, L. McPherson, Healdsburg, owner. There an undeveloped deposit of graphite of fair quality on this ranch Secs. 13, 14, 24 and 25, T. 9 N., R. 10 W., 4 miles west from Healdsrg. There are specimens from this deposit in the museum of the tate Mining Bureau. The material is suitable for use in paint manucture or for stove polish. By washing and floating it could be used lubricating compound.

Skinner Graphite Company, R. M. Skinner et al., Petaluma, owners. This graphite is on the Skinner ranch, in Sec. 14, T. 4 N., R. 7 W., 4 miles south of Petaluma on the San Rafael road. It was opened up in 1894, and the material shipped to San Francisco for paint manufacture. The output was valued at $9,000. Idle for several years.

Bibl.: Bull. 38, p. 281.

There is said to be a deposit of graphite 2 miles west of Cazadero. It is undeveloped. Specimens are also reported from other parts of the county.

Bibl.: R. VI, Pt. I, p. 111.

INFUSORIAL EARTH.

Collings Deposit, A. F. Collings, 1001 Orchard street, Santa Rosa, owner; John Frey, Eighth and Hooper streets, San Francisco, lessee. It is in Sec. 10, T. 8 N., R. 8 W., 1 mile north of Mark West Springs and 6 miles east of Windsor on the Northwestern Pacific railroad; elevation 600 feet (bar.). There is a bed of infusorial earth 5 feet thick, striking east and west, and dipping north at a flat angle. It is below a layer of soft, coarse-grained volcanic tuff; and has been worked by a small open cut and drift. A small tonnage was shipped in 1913.

Mt. Pisgah Vineyard Deposit, E. L. Goldstein Company, 333 Kearny street, San Francisco, owners. This is an undeveloped deposit of infusorial earth, said to indicate a large available tonnage. It is in Sec. 30, T. 6 N., R. 5 W., 2 miles northeast of Agua Caliente.

IRON.

There are indications of iron ore along the second ridge back from the shore line, beginning about 6 miles east of Fort Ross and continuing northwesterly into Mendocino County. The more important localities are:

Hooper Ranch, J. W. Hooper, owner, 5 miles north of Nobles.

Lancaster Ranch, W. M. Richardson, Plantation House, owner; east of Fisk's Mill. Both yellow ocher and hematite occur. Some of it is siliceous, and suitable for paint.

Fort Ross, a large body six miles east of Fort Ross.

Bibl.: R. IV, p. 182; XI, p. 461; Bull. 38, pp. 304, 365.

KAOLIN (see under Brick and Clay).

LIMESTONE.

Black Ranch Quarry, L. S. Black, Modesto, owner. This deposit is miles north of Geyserville on Little Sulphur Creek. The Sonoma County Lime Company, A. H. Ingram, Santa Rosa, manager, burned ome lime here in 1906–1907; but it is stated that they could not market he product on account of a labor boycott. No work has been done ince.

Bibl.: R. XII, p. 396; XIII, p. 633; Bull. 38, p. 93.

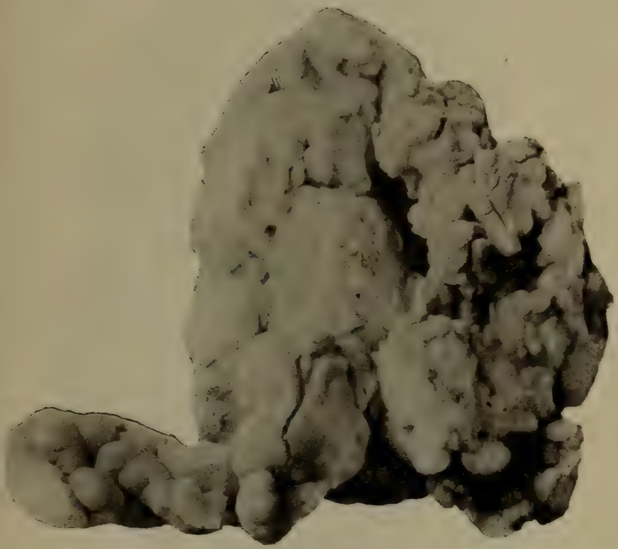

Photo No. 176. Magnesite from Kolling deposit near Preston, Sonoma County, California, showing shrinkage cracks. Two thirds natural size.

There is a large deposit of limestone in Secs. 1 and 2, T. 9 N., R. 12 W., 15 miles west of north from Cazadero. It is stated to be traceable for a mile in length, and in places up to 300 feet in width. It ould be used for building stone or for cement manufacture. It is a hard, fine-grained, compact limestone, red, white and cream colored. The deposit was at one time located by the Healdsburg Marble Company but abandoned on account of being too far from a railroad.

MAGNESITE.

There are numerous deposits of magnesite in Sonoma County, both large and small, as regards surface showings; but, on the whole, there has been too little development work to state anything definite yet as to their future productiveness. The largest deposits are handicapped so far by a lack of transportation facilities; but this feature will doubtless be improved before long. The total recorded production for the county has been but 870 tons to the end of 1913.

Photo No. 177. Small Vein of Magnesite in serpentine, showing botryoidal forms and shrinkage cracks. Two thirds natural size. Kolling deposit, Sonoma County, California.

For a statement of the properties and uses of magnesite see *Magnesite* under *Napa County.*

Bibl.: Bull. 38, pp. 331–333; U. S. G. S., Bull. 355, pp. 22–28 Bull. 540, pp. 490–498.

Ferdinand Albertz has an undeveloped deposit of magnesite on his ranch 1 mile southwest of Cloverdale.

Louis R. Ball, of Presidio, San Francisco, Cal., has an undeveloped deposit of magnesite near the Gilliam Creek deposits north of Guerneville, which are described below.

Brush Deposit, F. W. Brush took out about 250 tons of magnesite from a pocket on his ranch three miles east of Cloverdale. No further work has been done since 1909.

Bibl.: Bull. 38, p. 331.

Creon Deposit (see Kolling).

Cummings Ranch, Chas. G. Flick, owner. This deposit of magnesite in Sec. 23, T. 11 N., R. 11 W., about 2 miles southwest of Cloverdale, was worked for a short time by the Sotoyome Magnesite Company of Healdsburg. It has now been idle several years.

Bibl.: Bull. 38, p. 332; U. S. G. S. Bull. 355, p. 24.

Eckert Ranch (see *Yordi*).

Gilliam Creek Deposits (see *Healdsburg Marble Company,* and *Western Carbonic Acid Gas Company*).

Healdsburg Marble Company (also known as the *Madeira Deposit*), George Madeira, Healdsburg, manager. It is in the southwest corner of Sec. 31, T. 9 N., R. 10 W., 5½ miles north from Guerneville; elevation 1700 feet (bar.). There is a series of magnesite veins in serpentine from a few inches to 10 feet wide, and occurring over a width of about 1400 feet. They strike west of north and dip west at about 70°. The larger veins are of very good quality. There is a considerable tonnage in sight at the surface which can be cheaply quarried; but except for a couple of short tunnels there has been no development work underground.

At the west end, the veins are narrow and are banded with a green dolomitic material, chalcedony and quartz, forming a variety of "verde antique marble." It was for this that the deposit was originally located (1894), with the intention of putting it on the market as an ornamental building stone. This is the deposit described by Hess (see Bibl.) as "un-named."

The property has no transportation outlet as yet, but it is only a half mile from the claim of the Western Carbonic Acid Gas Company, which has a wagon road to Guerneville. The claims are patented.

Bibl.: R. XIII, p. 640; Bull. 37, p. 112; Bull. 38, pp. 114, 333, 369; U. S. G. S. Bull. 355, pp. 25, 26; Bull. 540, p. 497.

Kolling Deposit (formerly *Creon*), J. Kolling, Preston, owner. This s in Sec. 32, T. 12 N., R. 10 W., 2 miles north of Cloverdale and 2 miles east of Preston on the Northwestern Pacific Railroad; elevation 1500 feet (bar.). The wagon road to Preston has a heavy grade, but it is all down hill. It is stated to cost $1.50 per ton to haul the magnesite to the railroad. There are four small, disconnected deposits of magnesite, the geology of which has been described by F. L. Hess (U. S. G. S., Bull. 355, p. 22). The characteristic botryoidal forms and shrinkage cracks are abundant in parts of these deposits, and the edges of the veins are more or less mixed with serpentine. (See photos Nos. 176, 177).

Photo No. 178. Magnesite from Kolling deposit, Sonoma County, California, showing pitted surface due to weathering. Two thirds natural size.

A peculiar pitted weathering effect was also noted (photo No. 178). Something over 500 tons of magnesite have been shipped from the property, but no work has been done the past five years (to January, 1914).

There is some heavy magnesite float on the north bank and in the bed of Big Sulphur Creek, just above the mouth of the canyon. This is below and about a mile south of the Kolling ground.

Bibl.: Bull. 38, pp. 331, 332; U. S. G. S. Bull. 355, pp. 22, 23.

Madeira (see *Healdsburg Marble Company*).

Magnesite float was found by the writer in Mark West Creek a short distance above Mark West Springs, but its source was not located.

On land owned by *M. C. Meeker,* of Camp Meeker, in Secs. 2 and 3, T. 8 N., R. 11 W., northwest of Guerneville, are scattered indications of magnesite, but no development work has been done.

Norton Ranch, E. M. Norton, owner. The Sotoyome Magnesite Company, of Healdsburg, took out a small tonnage of magnesite from an irregular deposit on the Norton ranch on Dry Creek, about 10 miles northwest of Healdsburg and 4 miles from Geyserville. No further work has been done.

Bibl.: Bull. 38, p. 333; U. S. G. S. Bull. 355, p. 28.

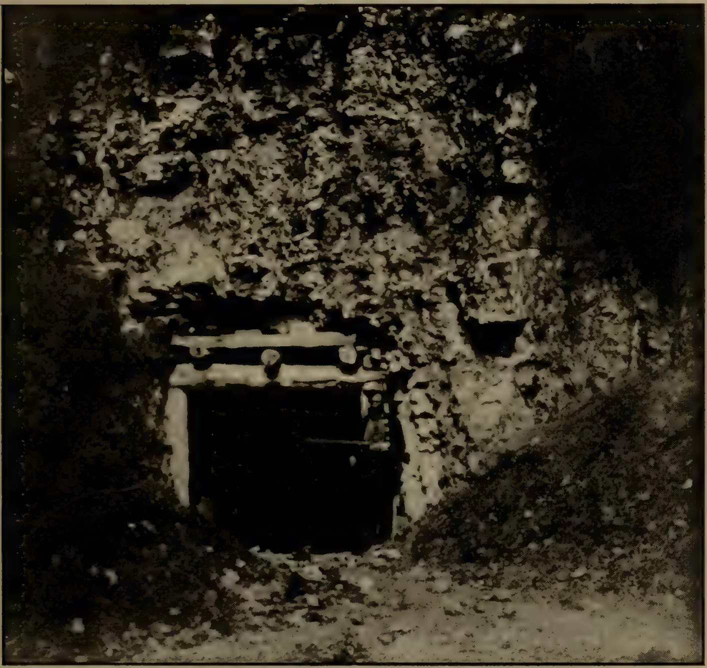

Photo No. 158. Upper tunnel, Cecilia Claim ("Red Slide"), Sonoma Magnesite Company, near Cazadero, Sonoma County, California.

Red Slide Deposits (see *Sonoma Magnesite Company*).

Sonoma Magnesite Company, U. S. Webb, president; Frank A. Janda, hicago, Ill., secretary; H. P. Bee, manager; John M. Nordheim, superntendent. San Francisco office, Humboldt Bank Building.

Since my visit to the property (November, 1913), the control of the ompany has been transferred from A. B. Davis et al., of San Franisco, to the above-named. The new owners are proceeding to patent he claims and propose to increase development and improve the transortation facilities. The ground was at one time located by Geo.

Madeira, of Healdsburg, but lost through litigation. (Bull. 38, p. 333; Bull. 66, pp. 58, 59.)*

There are 30 claims in this group covering what are known as the Red Slide deposits on East Austin Creek.

The claims as indicated on the map are named as follows:

1. Flora
2. Cecilia
3. Marie
4. Seymour
5. Cyril
6. Henrietta
7. Constance
8. Manson
9. Otto
10. James
11. Josef
12. Yard
13. Marquise
14. Peterson
15. Burris
16. Bertram No. 2
17. Arthur No. 2
18. Francis
19. Ford
20. Clara No. 2
21. Alfred No. 2
22. Vera No. 2
23. Trent No. 2
24. Bertram
25. Henry
26. Charles
27. Phillip
28. Vera
29. Empire
30. Standard

They are in Secs. 6, 7, 8, 17 and 20, T. 9 N., R. 11 W., 6 miles north from Cazadero (see map), but at present reached by road from Guerneville, 12 miles to the southeast. The company has a wagon grade about two thirds completed to connect with Watson station on the Northwestern Pacific Railroad, a distance of 11 miles. At the time of my visit this was the only work being prosecuted. By reason of inclement weather and a lack of time, a detailed study of the geology was not made.

There are three groups of magnesite outcrops with a northwest trend, in a large belt of serpentine. No work has been done on the northernmost one, which was not visited. Of the other two the principal work has been done on the lower group, mainly on the "Cecilia" claim at a sharp turn in the creek. Here there are two adits, the lower one of which is in over 200 feet, starting as a drift on the outcrop of a vein about 9 feet wide; but after 50 feet, turning to the northwest and running as a crosscut for about 180 feet, where a small step-faulted vein of magnesite was struck.

The upper Cecilia tunnel, which is supposed to cut the same formations as the lower, also starts on a large outcrop (see photo No. 158), but is run entirely as a crosscut. It is 50 feet above the lower tunnel and has cut veins showing widths of 12 feet, 5 feet, 15 inches, 18 inches, 6 inches, and 8 inches, as well as some smaller ones. This magnesite is of high grade as will be noted from the analyses quoted below. Magnesite outcrops in the creek bed here, and continues for a short distance

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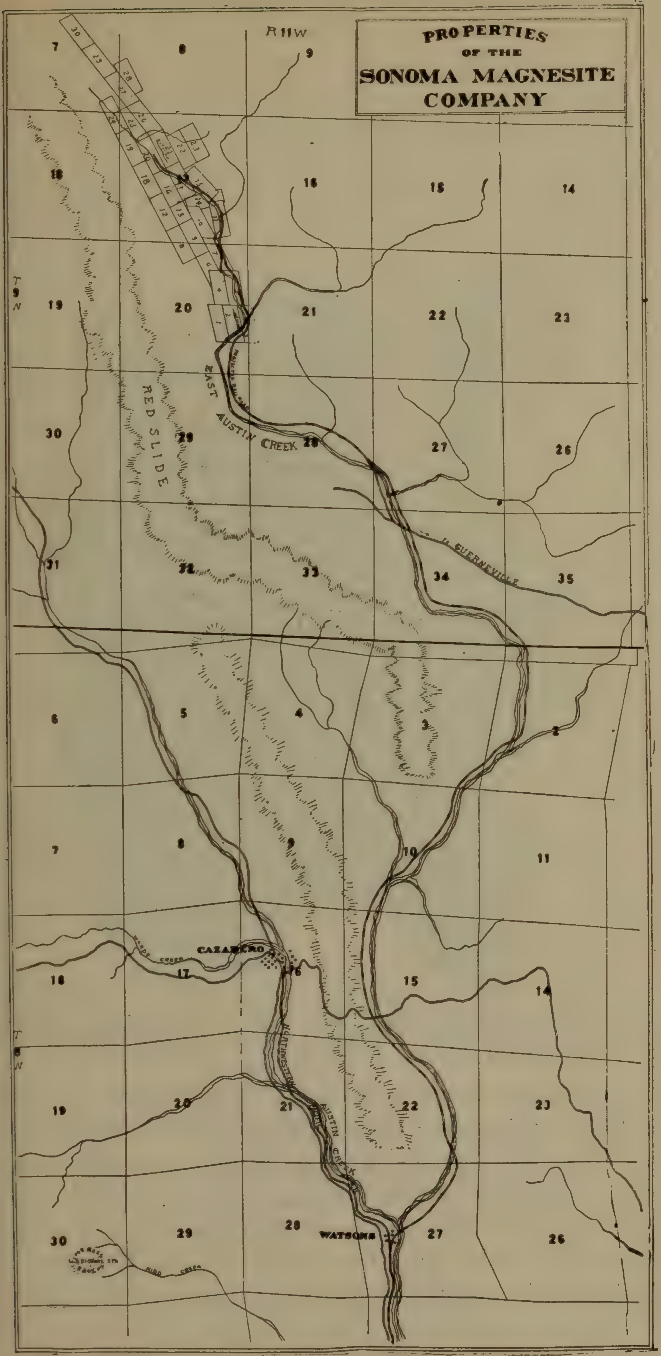
*Since this description of the property was put in type, the new company has completed its transportation connections, built a calcining plant, and is now making regular shipments. A 24-inch gauge railroad was laid on the road grade, and a distillate engine furnishes the motive power. Connection is made with the Northwestern Pacific at Magnesia station on a spur of about one-half mile from Watsons.

The magnesite is being mined at the lower deposit, where a quarry face has been opened up. In the calcining plant, a rotary kiln, oil-fired, is in operation, with capacity of 30 tons per 24 hours. A second kiln is stated to be enroute for installation. The crude mineral is crushed to pass a 2-inch ring before charging to the kiln; and the calcined material is pulverized after cooling in steel bins. Power is obtained by an oil-burning steam plant. The kiln consumes ¾ bbl. of oil per ton of calcined magnesia obtained, which is reduced to 5% CO_2. The finished product is packed in paper-lined duck bags for Pacific Coast consumption, and in 400-pound paper-lined barrels for the eastern market. Shipments are now being made to New York via the Panama Canal, an ocean rate of $5.00 per ton from tidewater, San Francisco, to New York having been secured. Seventy men are at work. —W. W. B., July, 1915.


PROPERTIES
OF THE
SONOMA MAGNESITE
COMPANY
R 11 W
T 9 N
T 8 N
RED SLIDE
EAST AUSTIN CREEK
GUERNEVILLE
CAZADERO
WARDS CREEK
NORTHWESTERN
AUSTIN CREEK
WATSONS
KIDD CREEK

up over the hill, but apparently does not cross the creek to the south. The general trend of the veins is about N. 25° W., and the dip northeast. There are a few hundred tons of broken magnesite on the dumps of these tunnels and as float below. Besides the usual characteristics, specimens were found exhibiting parallel shrinkage cracks (see photo No. 179). Almost no drifting has been done so far, so that the continuity or the extent of these veins underground is as yet uncertain.

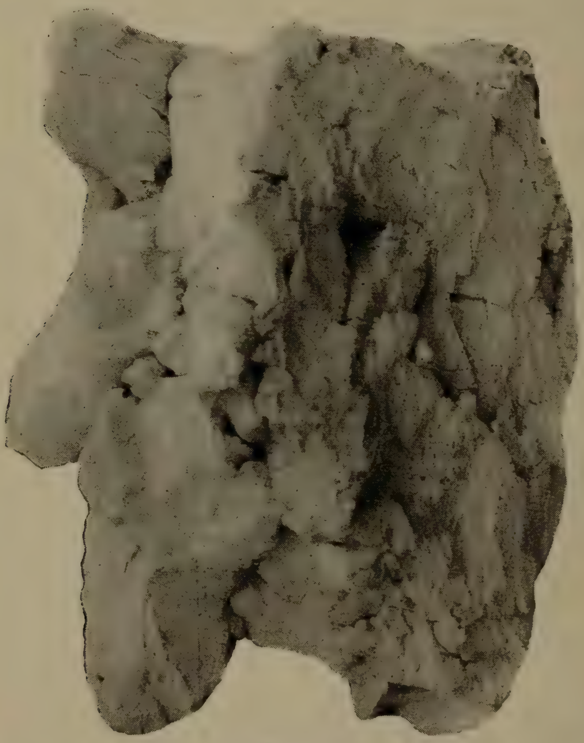


Photo No. 179. Magnesite from "Red Slide" deposit—Sonoma Magnesite Company, Sonoma County, California. Showing parallel shrinkage cracks. Two thirds natural size.

At the upper claims the principal outcrop is on the Alfred (see photo No. 159). It appears to be at least 25 feet thick at the center, dipping at about 40° NE., and is stated to have been traced for a total length of about 1000 feet. It thins out, however, in both directions from the center. The only development work on this group is a crosscut tunnel started near the creek over 200 feet below the outcrop, and which is in about 100 feet. It has not yet cut any magnesite. Vera No. 2 adjoins the Alfred.

There is also on the claims a good stand of cypress suitable for mine imbers, and some "fir" (Douglas spruce) and redwood.

It is intended when development has proceeded sufficiently to warrant t, to erect calcining furnaces on the property, a gas plant and possibly brick plant, and to convert the wagon grade into a railroad so as to andle the products direct to tidewater without transshipment.

It is stated that with properly equipped furnaces one barrel of crude il will produce one ton of calcined magnesite. Mr. Davis has gone uite thoroughly into the subject of the uses for magnesite, and its arket, and he estimates that with rail facilities to tidewater the aterial can be shipped to Chicago, New York and other eastern oints via Panama Canal at a rate which can compete with the Grecian nd Austrian product. The market in Japan and China can also be eached profitably.

ANALYSES.

Sample from—	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	CO_2	$MgCO_3$	Undetermined
ecilia (upper tunnel)	7.67	0.26	0.29	0.04	43.42	48.08	--------	0.24
ecilia	3.66	.75	.44	.20	44.90	49.20	--------	0.85
lfred	[6]2.50	0.55		[7]2.30	--------	--------	93.92	.36 [9].37
lfred	2.50	2.2		--------	46.0	[8]49.3	--------	--------
era No. 2 (calcined)	.74	5.05		None	94.21	--------	--------	--------
lfred (calcined)	6.66	10.22		.52	82.60	--------	--------	--------
era (calcined)	7.85	.21	4.63	--------	87.31	--------	--------	--------

[1] Analysis by A. J. Peters (U. S. Geological Survey).
[2] Analysis by W. C. Wheeler (U. S. Geological Survey).
[3] Analysis by Stauffer Chemical Company, San Francisco.
[4] Analysis by Selby Smelting and Lead Company, Selby, California.
[5] Analysis by Booth, Garrett & Blair, Philadelphia, Pa.
[6] Silicates.
[7] Calcium carbonate.
[8] Calculated.
[9] Moisture.

It appears from these analyses that some of the magnesite from the per claims carries more iron than that from the lower group; also at the content of silica is variable. As has already been noted (see troduction to *Magnesite* under *Napa County*), in the manufacture magnesia brick for basic open-hearth liners in the steel process, small percentage of iron (up to say 10 per cent) is not only permissie but desirable. So, if the eastern market can be reached economically, would seem that this lower grade material of the Sonoma Magnesite ompany may be made available some day.

Bibl.: Bull. 38, p. 333; Bull. 66, pp. 58, 59; U. S. G. S. Bull. 355, p. 26; Bull. 540, pp. 490–495.

Photo No. 159. Magnesite outcrop on Alfred Claim ("Red Slide") of Sonoma Magnesite Company, Sonoma County, California.

Sotoyome Magnesite and Mineral Paint Company (see *Healdsburg Paint Company,* under *Mineral Paint*).

Sotoyome Magnesite Company (see *Norton Ranch*).

Western Carbonic Acid Gas Company, Chas. S. Harker, Agnew, president and manager. This group is at the head of Gilliam Creek, in Sec. 6, T. 8 N., R. 10 W., 5 miles north from Guerneville, from which it is reached by wagon road, the last mile having been built by the company. This deposit is similar to that of the Healdsburg Marble Company, above it near the top of the ridge and about a half mile to the north. There are several large outcrops of magnesite occurring in serpentine. Very little development work has been done—a few surface cuts.

The following analyses of material from this group are given by H. S. Gale (U. S. G. S. Bull. 540, p. 497):

	No. 1	No. 2
SiO_2	3.51%	10.21%
Al_2O_3	1.10%	.31%
Fe_2O_3	.80%	.74%
CaO	1.46%	.59%
MgO	43.65%	41.06%
CO_2	49.16%	44.76%
Undetermined	.32%	2.33%
	100.00%	100.00%

Bibl.: U. S. G. S. Bull. 355, p. 24; Bull. 540, pp. 495–497.

Yordi Ranch (formerly *Eckert*), Mrs. Grace P. Yordi, Cloverdale, owner. It is 2 miles southeast of Cloverdale, on the east side of the Russian River; elevation 425 feet (bar.). Several years ago about 700 tons of magnesite are reported to have been dug from the soil-covered hillside above the road, and 400 tons shipped. It was not until 1912 that the balance was shipped to San Francisco. The magnesite was apparently residual boulders in the soil overlying a serpentine bedrock.

Bibl.: Bull. 38, p. 333; U. S. G. S. Bull. 335, p. 23; Bull. 540, p. 498.

MANGANESE.

Shaw Prospect, Estate of I. E. Shaw, Cloverdale, owner. There is a deposit of high grade manganese ore on the Shaw ranch, 7 miles northwest of Cloverdale, on which a small amount of development work has been done.

Bibl.: R. XII, p. 330; XIII, p. 507; Bull. 38, p. 337; U. S. G. S. Bull. 427, p. 163.

Besides the above, there are specimens of manganese ore in the museum of the State Mining Bureau from Freestone, Guerneville, Mark West Springs and Santa Rosa.

Bibl.: R. IV, p. 316; Bull. 38, p. 368.

MARBLE.

Healdsburg Marble Company (see under Magnesite; also under Limestone).

MINERAL PAINT.

Brown's Ochre Mine (see *Meeker*).

Healdsburg Paint Company, T. S. Merchant et al., Healdsburg, owners. This property was at one time known as the Indian Metallic Red Paint Mine, and also under the name of Sotoyome Magnesite and Mineral Paint Company. It is on Porter Creek in T. 8 N., R. 10 W., about 10 miles by road southwest of Healdsburg. The material is a low grade hematite, high in silica, and a considerable tonnage was shipped out some years ago, but none since 1906.

Bibl.: R. XI, p. 462; R. XII, p. 406; XIII, p. 643; Bull. 38, p. 340.

Lancaster Ranch (see under Iron).

Meeker's Ochre Deposit (formerly *Brown's*) M. C. Meeker, Camp Meeker, owner. This deposit of ochreous clay is in Sec. 21, T. 7 N., R. 10 W., 1½ miles north of Camp Meeker. Several years ago there were four or five carloads of paint shipped from this property, but none since.

Bibl.: Bull. 38, p. 340.

Occidental Deposit, J. D. Connelly, owner. There is an undeveloped deposit of ochreous clay, just west of the hotel at Occidental.

There is said to be a small spring deposit of yellow ochre 5 miles northeast of Cazadergo.

Skinner Graphite Company (see under Graphite).

Sotoyome Magnesite and Mineral Paint Company (see *Healdsburg Paint Company*).

MINERAL WATER.

Sonoma County, like its neighbors, Lake, Napa, and Mendocino counties, has a large number and variety of mineral springs. Some of these are well known, and have a world-wide reputation. They vary in character and composition from the cold ''seltzer'' of Lytton's to the boiling hot waters and steam vents of The Geysers. Most of them are well equipped with comfortable hotels and cottages, and are fairly accessible to transportation lines. Sonoma County is one of the ''playgrounds'' of California and many of her summer resorts are located around these mineral springs.

Agua Caliente Springs, Theodor Richards, Agua Caliente, owner. These springs are at Agua Caliente on the Northwestern Pacific Railroad, 2½ miles northwest from Sonoma; elevation 131 feet (Northwestern Pacific). It is stated that originally the hot spring here was merely a mud hole used for many years by the Indians. The present owner has drilled six wells, and put in a large swimming tank, a bathhouse, and a bottling works. The water is pumped, though it is stated that in the winter the wells have a small artesian flow.

The water pumped to the swimming tank shows a temperature of 102° F. at the pump (2 wells combined, 1 of which is said to be warmer than 102°). The well from which water is bottled shows a temperature of 95° F. at the pump, and is discharged into a tank to cool before bottling. Electric power is used, and there is an auxiliary gasoline engine for emergency use. There is a capping machine, carbonator, and mechanical labeler. There are accommodations for 300 guests in the hotel and cottages.

Bibl.: R. XI, p. 458; XIII, p. 521; U. S. G. S., Water Sup. Pap 338, p. 113.

Agua Rica Hot Sulphur Spring (see *Boyes*).

Alder Glen Springs, William Lang, Pioneer Soda Water Company, Oakland, owner; J. A. Serres, lessee. These springs are in Sec. 3, T. 11 N., R. 11 W., 3 miles northwest of Cloverdale; elevation 525 feet (bar.). McCray station on the Northwestern Pacific is the railroad point during the summer season. The springs are in serpentinized sandstone, and the four principal ones have the following temperatures: Sulphur, 58° F.; Magnesia, 56°; Soda, 57°; Iron, 57°. Water from the soda springs is bottled "natural" at the spring. Some is also shipped in barrels to Oakland and sold in siphons, carbonated. The hotel and cottages are picturesquely situated in a beautiful canyon of alders, redwoods and oaks.

Bibl.: WINSLOW ANDERSON, "Mineral Springs and Health Resorts of California," p. 76, U. S. G. S. Water Sup. Pap. 338, p. 166.

Altamont Medical Springs, J. D. Connelly, Occidental, owner. This is a lightly mineralized spring in Sec. 34, T. 7 N., R. 10 W., at Occidental on the Northwestern Pacific Railroad. None is bottled for sale. There is a hotel in connection.

Barcal Spring, Barcal Water Company, operators; J. Kolling, Preston, manager. This calcic-magnesic spring is near the Kolling magnesite deposit in Sec. 32, T. 12 N., R. 10 W., about 2 miles east of Preston on the Northwestern Pacific Railroad at an elevation of 1375 feet (bar.). They have been bottling for about seven years past, originally at the spring itself, but now the water is piped 9000 feet to the works at Preston station. Electric power is used and three men are employed. The product is put up both carbonated and natural. There is no resort in connection with this spring. Near-by there is also an iron spring, but not utilized.

Boyes Hot Springs (at one time called *Agua Rica*), Boyes Hot Springs Company, owners; Henry Trevor, San Francisco, president; Thos. P. Boyd, Santa Rosa, secretary; R. G. Lichtenberg and Dr. E. L. Parramore, managers. The post office and railroad station are both named Boyes Springs. It is 2 miles northwest of Sonoma; elevation 129 feet (Northwestern Pacific). The property was formerly owned by Captain Boyes, and has been operated by the present company for seven years.

Water is obtained from both springs and wells. It is pumped to tanks to give pressure for the bathhouse use, and also pumped to the bottling works, where it is cooled before bottling. Electric power is used. The bottling is done under lease from the company by John W. Kelly. Most of the production is carbonated, but a few cases per month, "still."

There is a fine large swimming pool and a well-appointed bathhouse. The temperature of the water of the principal spring was 112° F., taken at the pump. There are accommodations for 300 guests in the hotel, cottages and tents.

Bibl.: R. XI, p. 458; XII, p. 347; XIII, p. 521 U. S. G. S. Water Sup. Pap. 338, p. 112.

Burns Springs, F. M. Hathaway, owner. These springs are on the Hathaway ranch, 3½ miles east of Glen Ellen, but are not utilized except by the occupants.

Bibl.: R. XII, p. 347; XIII, p. 521.

California Geysers (see *The Geysers*).

Camp Rose. There is stated to be a sulphur water spring at the Camp Rose resort, 1½ miles from Healdsburg.

Chimney Rock Spring, J. A. Watson, Guerneville, owner. This sulphur water spring is at the corner of Secs. 26, 27, 34 and 35, T. 8 N., R. 11 W., 6 miles west of Guerneville; and is so called because of its proximity to a natural topographic feature of the same name. The elevation is 900 feet (bar.). It is stated that water has been bottled here in a small way by hand for about twenty-five years.

Eleda (see *Fetters*).

Fetters Hot Springs (one time called *Eleda*), George Fetters, owner. This resort at the post office of the same name is between Boyes and Agua Caliente springs in the warm water belt, extending northwesterly from Sonoma. Elevation 124 feet (Northwestern Pacific). There are 3 wells, stated to be artesian in winter, the first one of which was drilled in 1908. The warm water was struck at a depth of 300 feet. It is pumped, using electric power, to a tank, for swimming and bathing. A small amount is bottled, carbonated, for use at the hotel. The temperatures of the two principal wells are said to be 114° F. and 90° F., respectively, but as they are capped, and the pump was not running, I was unable to take a thermometer reading at the time.

Bibl.: U. S. G. S. Water Sup. Pap. 338, p. 114.

Geysers (see *"The Geysers"*).

Hoods Hot Springs, O. R. Baldwin, Cloverdale, owner. In the canyon of Dry Creek, 15 miles north of west from Cloverdale. Two springs. Temperature 100° F. Small flow. Used locally for bathing.

Bibl.: U. S. G. S. Water Sup. Pap. 338, p. 82.

Kawana Springs (formerly *Taylor's White Sulphur Springs*), J. S. Taylor, Santa Rosa, owner; P. Criblet, lessee. These springs are in Sec. 36, T. 7 N., R. 8 W., 2½ miles southeast from Santa Rosa; elevation 276 feet (bar.). The principal spring has a temperature of 57° F. The hotel has accommodations for about 100.

Bibl.: R. VI, Pt. I, p. 75; X, p. 676; U. S. G. S. Bull. 32, p. 209; Water Sup. Pap. 338, p. 256: ANDERSON (op. cit.), p. 264.

Lytton Springs (see *Salvation Army*).

Mark West Springs, J. O. Wickham, Santa Rosa, owner. These well known springs are in Sec. 14, T. 8 N., R. 8 W., 10 miles north of Santa Rosa, from which city they are reached by automobile stage; elevation 450 feet (bar.). The warm springs are on the edge of Mark West Creek. The following temperatures were observed: Bath Spring, 93° F. (strong flow); Magnesia, 90°; "Plunge," 92° (has excess gas); Sulphur, 90°; Arsenic, 65°; two, iron 58° each; one, iron 54°; two "iron" across creek from others, 67°. The Bath Spring water, when a higher temperature is desired, is heated artificially.

The hotels and tents will accommodate about 150 guests. One picturesque feature of this resort is the large wild grape arbor in front of the hotel. There are eleven trunks up to 8 inches in diameter, which are twined around the porch posts, and the vines spread out on the arbor frame over the driveway.

Bibl.: R. VI, Pt. I, p. 75; VIII, p. 634; XII, p. 347; XIII, p. 522; U. S. G. S. Bull. 32, p. 206; Water Sup. Pap. 338, p. 115; ANDERSON (op. cit.), p. 192.

On the *James O'Brien Ranch,* one mile northwest of Sea View, in Sec. 7, T. 8 N., R. 12 W., there is a cold mineral water well. It is at a station on the stage road west from Cazadero.

O'Donnell's Sulphur Spring is near Glen Ellen.

Ohms Springs—a drilled well ½ mile southeast of Boyes Springs. A small resort. Mrs. F. Shirley, Sonoma, owner.

Bibl.: U. S. G. S. Water Sup. Pap. 338, p. 113.

Salvation Army's Boys and Girls Industrial Home and Farm (inc.) (formerly Lytton Springs; also Golden Gate Orphanage), Major C. W. Bourne, president; A. E. Marpurg, secretary; post office, Lytton. These springs were originally and for many years known as Lytton Springs. The property is now maintained as an orphans' home by the Salvation Army. There are two principal springs, with the following temperatures: Soda, 64° F.; Seltzer, 62°. The soda spring is at an elevation of 425 feet (bar.), or 200 feet higher than the "seltzer" and ½ mile distant. The latter makes a very pleasant table water. A few cases of water per month are put on the market, being hauled in barrels to Healdsburg, and there bottled by a local company. The management desires to lease the bottling privilege.

Bibl.: R. VI, Pt. I, p. 74; VIII, p. 634; X, p. 675; XII, p. 347; XIII, p. 522; U. S. G. S. Bull. 32, pp. 205, 206, 211; Water Sup. Pap. 338, p. 165; ANDERSON (op. cit.), pp. 188–190.

Skaggs Hot Springs, Peter J. Curtis, Skaggs, owner. This group of well known hot springs is on Warm Spring Creek, in Secs. 23 and 24, T. 10 N., R. 11 W., 9 miles west of Geyserville, from which it is reached by a good automobile road. There has been a resort here since previous to 1875. The present owner bought the property in 1913, having had it leased for the five years previous.

There are three principal springs, all with good strong flows, and all have excess carbonic acid gas, especially the third one noted below, which is very vigorous. While nearly all of the hot springs, which have been observed by the writer, are more or less sulphurous, these at Skaggs are noticeably free from sulphuretted hydrogen. The following temperatures were recorded: 124° F., 125° and 130°. The last mentioned is inclosed by a concrete curb, and the others by brick. There is a cold soda spring about 300 yards above. There are accommodations for 200 in the hotel, cottages and tents. When visited (November, 1913), a swimming tank 30 feet by 60 feet was being built, and other improvements planned.

Bibl.: R. VI, Pt. I, p. 75; VIII, p. 634; X, p. 675; XII, p. 347; XIII, p. 522; U. S. G. S. Bull. 32, pp. 207, 211; Water Sup. Pap. 338, pp. 81, 82; ANDERSON (op. cit.), p. 244.

The State Home at Eldridge has a warm spring similar to the others in the Sonoma Valley.

Bibl.: U. S. G. S. Water Sup. Pap. 338, p. 114.

Taylor White Sulphur Spring (see *Kawana*).

"The Geysers," D. and H. A. Powell, San Francisco, owners; Chas. Boldsdorff, 199 Fourth street, San Francisco, lessee; post office, "The Geysers." These famous hot springs are in the northern corner of Sonoma County, in Sec. 13, T. 11 N., R. 9 W., 18 miles east of Cloverdale; elevation 1450 feet (bar.) on the hotel porch. During the summer months an automobile stage line runs to The Geysers from both Healdsburg and Cloverdale. From the latter it is a picturesque ride up the winding and rugged canyon of Big Sulphur Creek, one time called the Pluton River. Formerly there was also a stage line from Calistoga on the east.

These "geysers" themselves (though there are no true geysers that spout high in the air, as at the Yellowstone Park, Wyoming) are a series of boiling hot springs in two short tributary canyons on the north side of the creek, opposite the hotel (see photo No. 146 and No. 151). The ebullition is so violent in the one called the "Devil's Teapot" that a column of water about a foot across is continually projected 10 to 12 inches above the surface of the small surrounding pool. Because of this violent bubbling, I was unable to take the temperature of this particular spring, not having a registering thermometer. Scalded fingers were the reward of attempting to get it with the thermometer carried. Around this pool is a black deposit of iron sulphide. A small vent near-by gave 206° F., while at the "Devil's Kitchen" just below, over a space of several feet, temperatures of 130° to 202° were obtained. At a steam vent above, 210° was obtained and 206° at another black sulphur spring. Sulphur crystals are continually forming around the steam vents. Epsomite and other minerals, the result of deposition from the vapors and of efflorescence, are abundant.

Photo No. 146. The Geysers Canyon, Sonoma County, California, from across Big Sulphur Creek.

Just over a small ridge from the main group and in another ravine to the east, is the "Steamboat Geyser." This steam vent roars with sufficient pressure that a 2-inch rock dropped on it is thrown off violently before it has a chance to cover the aperture. The temperature is 212° F. In the early days of the resort, this vent was capped with a steam whistle (hence the name); but it is stated to have been blown off. Because of the noise it never was replaced.

On the edge of the main creek below these ravines, are a number of other springs, the principal ones having the following temperatures: "White Sulphur," 68° F.; "Hot Sulphur," 100°; "Hot Iron," 130°; "Hot Magnesia," 143°. The last named is the one from which water is bottled for sale. Formerly the bottling was done at The Geysers. Now, except for a few cases per month for use at the hotel, it is shipped in barrels to San Francisco and Richmond for bottling. The hotel, which has accommodations for 150, is usually closed from October to May first.

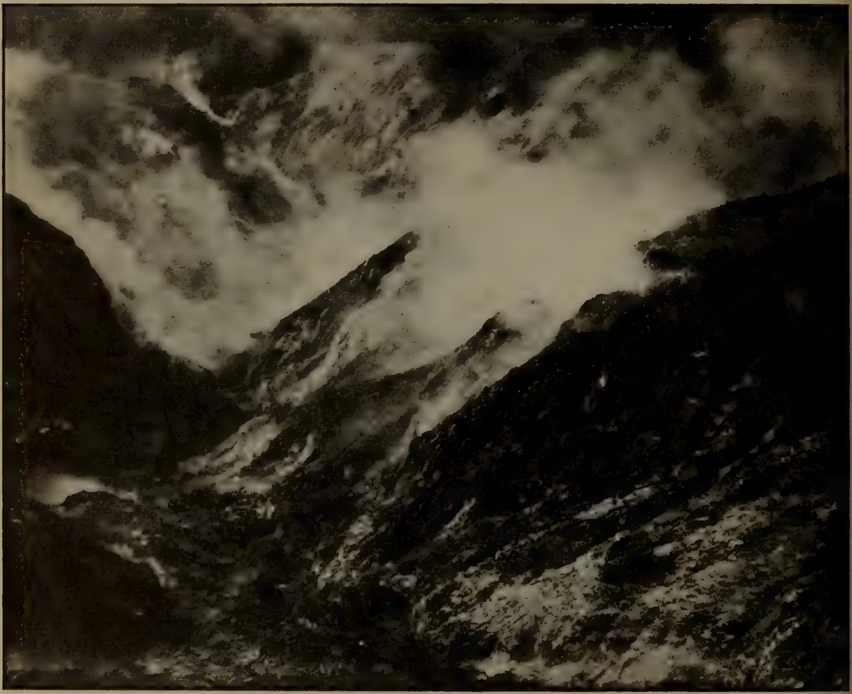


Photo No. 151. Looking down the Geysers Canyon, Sonoma County, California.

Because of the neighboring quicksilver districts, these solfataric springs have been much described and discussed in relation to the association of hot springs with the genesis of quicksilver ores. Along Big Sulphur Creek, both above and below Geyser Canyon, are several other places of similar deposits but where activity is now extinct. There is a "sulphur bank" a short distance below. The "Little Geysers" are 3 or 4 miles above the main group.

Bibl.: R. IV, p. 182; VI, Pt. I, p. 75; VIII, p. 635; X, pp. 672–675; XII, p. 347; XIII, p. 521; U. S. G. S. Mon. XIII, p. 377;

Bull. 32, pp. 204, 206; Water Sup. Pap. 338, pp. 83–88; ANDERSON (op. cit.), pp. 136–154; GEOL. SURV. OF CAL., Geology Vol. I, pp. 93 *et seq.*

Wall Spring, H. C. Wall, Hilton, owner. This is a magnesia spring in Sec. 30, T. 8 N., R. 9 W., northeast of Hilton. There was formerly a resort here but it has been closed the past two years.

Bibl.: U. S. G. S. Water Sup. Pap. 338, p. 257.

In addition to the above springs there is a cold magnesia spring on Mt. Jackson near Guerneville, *G. F. Austin,* owner; a cold sulphur water spring on the *J. C. Junker* ranch above the Great Eastern quicksilver mine near Guerneville; a warm sulphur water spring on land of the *Sonoma Magnesite Company,* north of Cazadero; *Los Guilicos Warm Springs,* 1½ miles southwest of Kenwood; and *McEwan Ranch,* 3 miles southwest of Kenwood. About ½ mile south of Glen Ellen, on the edge of the creek, there is a spring; temperature 76° F.; with excess CO_2, though it has no distinct mineral taste. None of these springs are at present utilized. There are also a number of small, locally known, cool sulphur springs on Sulphur Creek and Little Sulphur Creek, near Cloverdale.

Bibl.: U. S. G. S. Water Sup. Pap. 338, pp. 114, 258.

NATURAL GAS.

At several places, in the vicinity of Geyserville and in the valleys of Sonoma and Petaluma creeks, an inflammable natural gas has been encountered in well boring operations, but no commercial supply developed.

Bibl.: R. VII, p. 181; XI, p. 458.

ONYX MARBLE.

(See *Healdsburg Marble Company,* under Magnesite).

OPALS (see Gems).

PAVING BLOCKS (See Stone Industry).

PETROLEUM.

There are some small outcrops of oil-stained sand (asphaltic base) on the Ducker ranch, three miles due east of Petaluma; elevation 280 feet (bar.). The Petaluma Oil and Development Company, M. S. Meeks, secretary, has a lease on the ground, but no work has been done since the spring of 1910. Under sublease from this company, the Ramona Oil

Company drilled three shallow holes and the Petaluma Home Oil Company one.

The log of well No. 1 was as follows:

Buff sand	65 feet
Blue clay	597 feet
Brown sand	38 feet
Blue clay	100 feet
Total depth	800 feet; gas struck

It is stated that the gas showed a pressure of 217 pounds and a flow of 690,000 cubic feet per 24 hours. It was utilized under the boilers in sinking the second well until the flow was cut off by the well clogging up

The log of well No. 2 shows oil sands at depths of 335 to 340, 346 to 352, 397 to 399 feet, followed by a succession of shale, shell and gumbo strata to 910-foot depth. The strata exposed in the bed of a small creek about 300 feet west of the derrick show a strike east and west and a dip of about 40° to the south.

Oil seepages and gas are reported in Bennett Valley on the Parsons ranch, 7 miles due north from Petaluma.

Bibl.: Report XI, pp. 453–463; Bull. 69, p. 472.

QUICKSILVER.

Outside of the New Almaden mine in Santa Clara County, the Sonoma County quicksilver deposits (particularly those of the Pine Flat district) are among the oldest known in the state. They vary in character from the ordinary, mainly cinnabar-bearing ores, and the less common meta-cinnabarite, to the purely native mercury type as in the Rattlesnake and the Socrates. This last named group is found in the Pine Flat district, southeast of The Geysers; and has proven so far the most difficult to handle both from a mining and a metallurgical standpoint.

Prospecting and exploitation of the Pine Flat belt of deposits began in the early sixties and in 1861 some 33,000 feet of claims had been located on it (Geol. Surv. of Cal., Geology, Vol. I, p. 89). Among the claims being worked in that year were the Cincinnati, Dead Broke, Pittsburg, Pioneer (later renamed Socrates), and Denver. Though small amounts of quicksilver were produced by a retort from the Pioneer's native mercury ore, the result was not profitable from a pecuniary standpoint. The first definitely recorded output of quicksilver in the county was from the Sonoma mine in the same district in 1873 (Min. Res. West of the Rocky Mts., 1874, p. 30).

As will be noted from the table of mineral production (see page 144), there have been two principal periods of activity in the yield of quicksilver from Sonoma County mines—1874 to 1883 and 1888 to 1906. From 1882 to 1894, the Great Eastern mine was the only producer.

The total recorded output for Sonoma County to the end of 1913 was 61,407 flasks valued at $2,533,228. (For further descriptions as to market values, also metallurgy, see introduction to Quicksilver under Lake County.)

Bibl.: R. IV, p. 336; V, pp. 95, 96; VI, Pt. I, p. 102; VIII, p. 632; X, p. 675; XI, p. 460; XII, p. 371; XIII, pp. 602, 603; Bull. 20, p. 19; Bull. 27, pp. 97–117; GEOL. SURV. OF CAL., Geol., Vol. 1, pp. 88–91; U. S. G. S., Mon. XIII, pp. 362–364, 369, 376, 377; Min. Res. 1883, 1884, 1888, 1902, 1906, 1907, 1908, 1909, 1910, 1911, 1912, An. Rep. XVI, Pt. III, p. 598; XX, Pt. VI, p. 271; XXI, Pt. VI, p. 278; Trans. A. I. M. E., Vol. III, pp. 273, 275, 276, 290, 300, 304.

Almaden, Incandescent and Tunnel Site Group. These prospects near the Socrates mine have been abandoned several years. A 10-pipe retort was built.

Bibl.: Bull. 27, p. 97.

Altamont Copper Group. Quicksilver has been reported on these copper claims north of Camp Meeker, but no definite vein or ore body has been found.

Bacon Consolidated Group. On Pine Mountain. Abandoned.

Bibl.: Bull. 27, p. 97.

Big Chief Claim (see *Squaw*).

Black Bear Mine (see *Culver-Baer*).

Boston Group. These prospects about a mile east of the Pine Flat schoolhouse have been idle for the past 8 years. It is stated that a homestead has been lately filed on the land by Charles Acy.

Bibl.: Bull. 27, p. 97.

Bright Hope Mine. F. P. Tiran, Cloverdale, owner. This prospect is on an 80-acre piece of land held under an agricultural patent. It is on the Geysers road 15 miles east of Cloverdale, and 2 miles above the Cloverdale mine on the opposite side of Big Sulphur Creek; elevation 1475 feet (bar.). There are two crosscut tunnels on the stage road level, one in 180 feet and the other 450 feet. The latter attains a depth of 100 feet below the surface, and has drifts of 75 feet west and 60 feet east, also a 50-foot winze. The country rocks are sandstone and serpentine. The ore occurs partly in a ledge and partly as an impregnation in the sandstone. Both cinnabar and native quicksilver are present, with quartz as the principal gangue mineral, mixed with some serpentine. No ore has been taken out as yet except that in the course of development. There is no reduction equipment.

Buckeye Claim. F. Baumeister and George Hemenway, Cloverdale, owners. Elevation 2100 feet (bar.). This was formerly the Mt. Vernon claim of the Cloverdale group, which it adjoins, and was located by the present owners in 1910. Subsequent court proceedings confirmed their title to the ground, which it is intended to patent after this year's (1914) assessment work is done.

The ore-bearing zone is stated to be 100 feet wide and is made up of chert, impregnated sandstone, and stock-works, carrying cinnabar. This zone, which strikes northwest and southeast in the Cloverdale, turns abruptly to the south at the Squaw and Buckeye, crossing to the opposite side of Big Sulphur Creek; then turning again runs south of east through the Bright Hope, passing to the south of The Geysers and continuing southeasterly through the Socrates in the Pine Flat section. In the Cloverdale the dip is northeast at about 70°, east at the Buckeye, and southwest at the Socrates. While native mercury is a characteristic in the southern part of this zone, none is found in it north of Big Sulphur Creek. The Buckeye is being developed on three levels by an open cut and two tunnels, the lowest of which will give 200 feet of backs. There is a shaft of 50 feet and a tunnel of 300 feet, which were driven by the original locators. There are 200 tons of ore said to average 5 per cent, broken in the open cut.

Bibl.: Bull. 27, p. 99.

Cinnabar King Group. Cinnabar Mining Company, owners. Eli Bush, Healdsburg, treasurer. This group of 5 patented claims in Sec. 11, T. 10 N., R. 8 W., has been idle the past five years. The occurrence of ozocerite has been noted in this mine, associated with quicksilver.

Bibl.: R. XI, p. 461; XII, p. 371; XIII, p. 602; Bull. 27, p. 98; U. S. G. S. Min. Res., 1910, Pt. I, p. 701.

Cloverdale Mine. F. E. Johnston, Napa, and Harry Patten, Calistoga, owners. This group consists of the Cloverdale, already patented, and 5 other claims and a millsite which the owners are preparing to patent. The mine has had a somewhat intermittent history, having first been opened up in 1872. Its total production to the end of 1912 has been 5077 flasks, valued at $250,000. It is in Sec. 4, T. 11 N., R. 9 W., 12 miles east from Cloverdale, on the ridge between Big Sulphur and Squaw creeks, at their junction, the mine workings and reduction plant being on the slope toward the former. The topography is very steep, the elevation being 1000 feet at the furnace and 2200 feet (bar.) at the top of the ridge.

The ore body is characterized by ''ledges of thinly stratified chert, inclosed by sandstone.'' The cinnabar occurs as ''face metal'' and incrustations in the fissures of the more compact chert beds, and as richer seams and bunches in the crushed portions. The chert is highly siliceous. The deposit has been opened up at several different levels, by both open cuts and tunnels. The earthquake of 1906 is stated to have disclosed the edge of an ore shoot in the ''Glory Hole'' cut, from which about $40,000 in quicksilver was produced. As a whole the underground workings are not very extensive, the major portion of the output having come from the open cuts. With topography decidedly in their favor, the ore is handled a surprisingly unnecessary number of times between the mine and the furnace. The latter, which is of 25 tons capacity, is an incline, tile furnace with reverberatory hearth.

The property has been idle the past two years except for a small tonnage of ore retorted, to ''sample'' the ore body. Mr. Johnston states they are not operating on account of the unsatisfactory labor situation and the low price of quicksilver.*

Bibl.: R. X, p. 675; Bull. 27, pp. 98–102, 215, 217; U. S. G. S. An. Rep. XXI, Pt. VI, p. 278; Min. Res. 1902, p. 253; 1907, Pt. I, p. 554; 1910, Pt. I, p. 701; 1911, Pt. I, p. 904; 1912, Pt. I, p. 944; MIN. RES. W. OF ROCKY MTS., 1875, pp. 14, 177; 1876, p. 20.

Clyde Mine (see *Culver-Baer*).

Crown Point Quicksilver Mining Company (see *Sonoma*).

Culver-Baer Mine, Culver-Baer Mining Company, owners; C. E. Humbert, president; J. P. Menihan, secretary; home office, Cloverdale. The holdings of this company now include, besides the Culver-Baer group, proper, the Black Bear, Clyde, Kentucky, Missouri and Sonoma groups. The last named group was bought about three years ago and its 24-ton Scott fine ore furnace removed to the Culver-Baer. With the exception of the Sonoma, these claims are at the head of Devil's Den, a branch of Little Sulphur Creek, in Sec. 23, T. 11 N., R. 9 W., 20 miles south of east from Cloverdale. The Culver-Baer group proper includes the old Geyser and Oakland mines, of early days, which were producers for several years previous to 1880. In 1875 the Oakland mine was producing 100 flasks per month with six retorts. The property is credited with a total production to the end of 1912 of 8154 flasks.

The topography is rugged; elevation 2200 feet (bar.) at the stable. The ledge is characterized by a bold outcrop of silicified sandstone with abundant yellow ochre, and is traceable on the surface for a mile in length. The vein filling is mostly quartz with some lime and chalcedony. The ore carries cinnabar, meta-cinnabarite and some native mercury. The ledge averages 100 feet in width but only 35 feet on the footwall is stoped. It strikes northwest, dips northeast on an average of 60° and has been drifted on, all told, for a length of 1200 feet. The hanging-wall is serpentine.

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*Since the above was written, we are informed that a concentration plant is being installed; also, the price of quicksilver has gone up on account of the European war.

The three main levels are the upper tunnel of 700 feet in length, the lower tunnel in 2000 feet, and 300 feet below, and an intermediate level which does not come to the surface. These two tunnels are connected by a raise from the 1200-foot point in the lower one. At the time the mine was visited (October, 1913) it was idle, only a watchman being retained; but since then a few men have been put on to drive a new raise, starting at 1960 feet in the lower tunnel. One stope from the No. 1 raise is 25 feet wide by 90 feet long and has 400 feet of backs. They have not yet reached the ground worked by the old company.

The equipment includes an air compressor driven by a 25 horsepower Fairbanks-Morse gasoline engine; also Cleveland stopers and an 8-inch by 10-inch jaw crusher. There is a 16-ton Knox Osborne coarse ore furnace, a 24-ton, Scott fine ore furnace and a retort. A small steam engine drives the furnace blower. A field kiln of 118,000 bricks for furnace work was burned three or four years ago from clay near the mine.

Bibl.: R. IV, p. 336 (table); V, p. 96; XI, p. 461; XII, p. 371; XIII, pp. 602, 603; Bull. 27, pp. 102–105, 113, 215; U. S. G. S. Mon. XIII, p. 377; Min. Res. 1902, p. 253; 1907, Pt. I, p. 680; 1908, Pt. I, p. 690; 1909, Pt. I, p. 554; 1910, Pt. I, p. 701; 1911, Pt. I, p. 904; 1912, Pt. I, p. 944; MIN. RES. W. OF ROCKY MTS., 1875, pp. 14, 175, 177, 493; TRANS. A. I. M. E. Vol. III, pp. 276, 304.

Crystal (see *Pacific*).

Double Star, near Pine Flat. Abandoned. No ore was found after considerable development.

Bibl.: Bull. 27, p. 105.

Eureka Mine (originally *Flagstaff*), Eureka Quicksilver Mining Company, owner; James B. Barber, 1421 High street, Oakland, president. This group of four claims and three millsites, part of which is patented, is in the Pine Flat district, in Sec. 32, T. 11 N., R. 8 W., about 25 miles by road northeast from Healdsburg and the same distance northwest from Calistoga. Outside of a small amount of prospecting work done as assessments to hold the unpatented claims, the property has been idle the past ten years. It is northwest of and adjoins the Socrates.

The ore body is on the contact between a serpentine hanging-wall and sandstone footwall, being in part altered and gouge material from both. Values occur as cinnabar, meta-cinnabarite and native mercury, about 50 per cent being native. There is one tunnel in about 1000 feet, giving 300-foot backs, and several other shorter ones above. The lowest tunnel has drifts of 250 feet and 100 feet, respectively. Another tunnel has been started at a still lower level. There is a 10-ton, modified Livermore-Fitzgerald furnace, a gasoline engine and a small compressor included in the equipment. A few flasks of quicksilver were produced in 1904.

Bibl.: Bull. 27, pp. 106–108; U. S. G. S. Mon. XIII, p. 376; MIN. RES. W. OF ROCKY MTS., 1875, pp. 14, 176.

Great Eastern Mine, Great Eastern Quicksilver Mining Company, owner; George Roeth, 125 Market street, Oakland, president. This mine is in Sec. 16, T. 8 N., R. 10 W., 4 miles northeast of Guerneville by a good road; elevation 360 feet (bar.). Production of quicksilver began here with an output of 412 flasks in 1875; and the mine is credited with a total output to date of 40,923 flasks, or about two thirds of the total output of Sonoma County to the end of 1912. This includes the yield of the Mt. Jackson mine adjoining, as the two were operated in conjunction for a number of years, and their individual figures are not separable. As has already been noted (see introduction to Quicksilver), from 1882 to 1894, the Great Eastern mine was the only producer in Sonoma County.

This Great Eastern-Mt. Jackson lode is peculiar because of its isolation from other workable quicksilver deposits and from any known eruptives. It resembles somewhat the Culver-Baer ledge with its bold, ochreous outcrop between a serpentine hanging-wall and sandstone footwall. The strike is north of west and dips north at 50° to 60°, being steeper at the surface. The Great Eastern vertical shaft is down 550 feet, with two winzes of 160 feet each sunk from the 500-foot level. There is also a 400-foot drift on the 500. The collar of the shaft is about 200 feet below the upper outcrop, and at that level there is a tunnel in 1100 feet, with connecting drifts and stopes in the ledge above. From the shaft there are levels at 150, 220, 360 and 500 feet, respectively.

The ore shoot is enclosed within the ledge of opalized rock which was originally probably mostly serpentine. Becker (U. S. G. S. Mon. XIII, p. 364) considers that this silicification "preceded the deposition of ore, though somewhat closely connected with it." Occasionally a little pyrite accompanies the cinnabar. There are also small seams of a hard bitumen associated with the ore body.

The geology is discussed in detail by Becker (op. cit.), and in Bull. 27 of the State Mining Bureau (pp. 108–112).

For several years previous to 1905 (in which year it expired), the Great Eastern Company had a lease on the Mt. Jackson ground adjoining and worked it through the Great Eastern levels. The earthquake of April 18, 1906, shook from the outcrop cliff near-by a large rock which rolled into the shaft, killing three men coming up in the cage. It also partially wrecked the shaft. The damage to the shaft has been repaired, but the mine has not been operated since. At the present time (January, 1914) they are investigating the practicability of concentrating the ore. There is an abundant water supply from several springs on the property.

The hoist is operated by a wood-burning steam plant. The crusher is at the hoist, and a gravity tram conveyed the ore to the furnaces. The reduction equipment includes a 4-ton coarse-ore furnace, a 16-ton Hüttner-Scott fine ore furnace and a "D" retort.

Bibl.: R. IV, p. 336 (Table); V, p. 95; VIII, p. 633; XI, p. 460; XII, 371; XIII, p. 602; Bull. 27, pp. 108–112, 226, 239, 246; U. S. G. S. Mon. XIII, pp. 362–364; An. Rep. XX, Pt. VI, p. 271; MIN. RES. 1883, pp. 394, 396, 397; 1902, pp. 251, 253; 1907, Pt. I, p. 680; 1908, Pt. I, p. 690; MIN. RES. W. OF ROCKY MTS., 1875, p. 14; 1876, p. 20; MINING AND SCIENTIFIC PRESS, Vol. 89, p. 391.

Great Northern. Abandoned.

Bibl.: Bull. 27, p. 112.

Hope Claims (see *Sonoma Consolidated*).

Hurley Prospect. Abandoned.

Bibl.: Bull. 27, p. 112.

Lookout Group. Abandoned.

Bibl.: Bull. 27, p. 113.

Lucky Stone Group. Abandoned.

Bibl.: Bull. 27, p. 113.

Maricoma Prospect (*Santa Rita*). Abandoned.

Bibl.: Bull. 27, p. 113.

Mercury Mining Company. F. A. Huntington et al., San Francisco, wners. For several years nothing but a small amount of assessment work has been done on these prospects in Secs. 32 and 33, T. 11 N., R. 8 W., near the Socrates mine.

Bibl.: Bull. 27, p. 113, U. S. G. S., Min. Res. 1902, p. 252; MIN. RES. W. OF ROCKY MTS., 1875, p. 14.

Missouri Mine (see *Culver-Baer*).

Mt. Jackson Quicksilver Mining Company, O. T. Hassett, Geyserville, R. F. D., president. This mine adjoins the Great Eastern mine (*q. v.*) near Guerneville on the northwest, but has no plant of its own, having been worked for a number of years through the Great Eastern levels. It has been idle since 1905.

Bibl.: R. VIII, p. 633; XII, p. 371; XIII, p. 602; Bull. 27, pp. 108–112.

Napa Prospect. Abandoned.

Bibl.: Bull. 27, p. 113.

Occidental and Healdsburg Group. Abandoned.

Bibl.: Bull. 27, p. 114.

Old Chapman Prospect. Abandoned.

Bibl.: Bull. 27, p. 114.

Pacific Group (*Crystal or Red Cloud*), A. Abbey, George Roeth et al., Oakland, owners. They consist of four patented claims in Secs. 5 nd 6, T. 10 N., R. 8 W., near the Sonoma group in the Pine Flat section. No work has been done for several years. A watchman only is employed.

Bibl.: R. XIII, p. 603; Bull. 27, p. 114; U. S. G. S., Min. Res. 1902, p. 253.

Pontiac Group (see *Socrates*).

Rattlesnake Mine. Parrott Estate et al., San Francisco, owners. This mine is in Sec. 31, T. 11 N., R. 8 W., on the road between the ulver-Baer and the Sonoma mines. It is credited with a production of 5 flasks in 1875, entirely from native quicksilver. Not only was the metal entirely in the native state, but it is claimed that there was so much mercurial vapor in the underground workings that if a lunch ucket were left in over a day or two, the solder would become amalamated and the bottom drop out. The mine has been idle for years, and is now inaccessible. Like the Socrates, the difficulty here was to handle the native metal economically. If the underground situation could be handled successfully and safely, it would seem that the ore-dressing end might be solved by some system of concentrators or hydraulic settlers.

Bibl.: R. IV, p. 336 (table); XIII, p. 603; Bull. 27, p. 115; U. S. G. S., Mon. XIII, p. 377; Min. Res. W. of Rocky Mts., 1874, p. 37; 1875, pp. 14, 176; Trans. A. I. M. E., Vol. III, p. 273.

Red Cloud Claim (see *Pacific*).

Santa Rita Claim (see *Maricoma*).

Socrates Mine (originally *Pioneer*). Socrates Consolidated Mining Company, owner; L. T. Carr, 412 Montgomery street, San Francisco. This group of patented claims is at the junction of Secs. 32 and 33, T. 11 N., R. 8 W., and Secs. 4 and 5, T. 10 N., R. 8 W., on the divide between Big Sulphur and Little Sulphur creeks, 6 miles southeast of The Geysers. The Pioneer of this group was the first quicksilver claim located in Sonoma County. It is in the Pine Flat section. Owing to the difficulty of handling the native metal which makes up the major portion of the values here, the mine was idle for many years. The occurrence of selenide of mercury has also been noted in the Socrates. During its last period of operation attempts were made to recover the quicksilver with a rotary roasting furnace. Their surface plant was destroyed by a forest fire in the fall of 1907. During 1908 and 1909, the Socrates Development Company, operating the property under bond, made a small output of quicksilver, employing a Huntington mill and a Woodbury concentrator. The concentrates were retorted. Since that time the mine has been closed, only a watchman being employed.

Bibl.: Bull. 27, p. 115; U. S. G. S., Mon. XIII, p. 376; Min. Res. 1902, p. 253; 1906, pp. 493, 497; 1907, Pt. I, p. 680; 1908, Pt. I p. 690; 1909, Pt. I, p. 554; 1910, Pt. I, p. 701; Geol. Surv. of Cal. Geol., Vol. I, pp. 88–91; Min. Res. W. of Rocky Mts., 1875 pp. 14, 177; Mining and Scientific Press, Vol. XC, p. 22.

Sonoma Consolidated Group (Crown Point and Hope). This grou in Secs. 4 and 5, T. 10 N., R. 8 W., Pine Flat district, is now owne by the Culver-Baer Company (*q. v.*). This company bought th property particularly for its surface equipment, which has been transferred to the Culver-Baer mine 5 miles to the northwest. The Sonom vas last operated by the Crown Point Company. Production began vith an output of 50 flasks in 1873.

Bibl.: R. XIII, p. 503; Bull. 27, pp. 102, 112; U. S. G. S. Mon. XIII, p. 377; Min. Res. 1902, p. 253; Min. Res. W. of Rocky Mts., 1874, p. 30; 1875, p. 14; Trans. A. I. M. E., Vol. III, p. 290.

Squaw and Big Chief Claims. L. D. Kissack and John June, Cloverale, owners. These claims are in Sec. 4, T. 11 N., R. 9 W., adjoining he Cloverdale mine, 12 miles east from Cloverdale; elevation 2200 feet bar.). The ore is similar to that of the Cloverdale. A tunnel and a hort incline from it have been driven in about 60 feet, and a few sacks f high grade ore sorted from the material taken out. It is intended to atent the Squaw soon.

Walker Prospect. On patented ground near Guerneville, owned by I. C. Meeker, of Camp Meeker. A few stringers carrying cinnabar are aid to have been found, but nothing of consequence developed.

Bibl.: Bull. 27, p. 116.

Wall Spring Prospect. H. C. Wall, Hilton, owner. Idle.

Bibl.: Bull. 27, p. 117.

STONE INDUSTRY.

The stone quarries' products have been one of Sonoma County's iost important assets for many years. The majority of the paving locks employed in street work in the cities of the state have come rom the quarries of this county. For a considerable period this articular branch was much more prominent than it is at the present me, and gave employment to several thousand men. Following the an Francisco fire of 1906, the demand for paving blocks was good for time and the year 1912 was a prosperous one; but the Block Makers' nion demanded raises in the contract price successively from $25 to 30, then to $35 per 1000. This, coupled with the increasing number of iotor driven vehicles and their demand for a smoother pavement, caused heavy slump in the business. As a consequence, the year 1913 saw perations at many of the quarries shut down altogether, while others ere curtailed to the output of only a few men. It is stated that one ian will make an average of 100 to 150 blocks per day. At the time iey were visited (October, 1913) there were approximately 1,600,000 locks piled up at the various quarries and at the railroad shipping oints, awaiting a market.

In addition to the $35 per 1000 for making, those operators who are asing pay $3 to $3.50 per 1000 royalty to the owners. It costs from 2 to $5 per 1000, depending on the distance, to haul them to the railroad. In case they can not be loaded directly onto the cars but have to be temporarily piled beside the track, it costs an additional $1.50 per 1000 to put them on the cars. The blocks sell at $45 to $50 per 1000, f. o. b. the rail shipping point.

Though they are loosely designated by the trade as "basalt blocks," the rock for the most part is andesite. Particularly is this the case along the ridge which starts above Rincon Valley, northeast of Santa Rosa, and trends southeasterly to near Kenwood. Locally, in places, it grades to basalt, and at others to trachyte. This stone is also employed for making curbing, and as such was erroneously reported for a number of years under the head of "granite" (as has already been noted. See under *Granite*).

The following table gives the production of paving blocks for Sonoma County, from 1887, though the Petaluma quarry was worked as early as 1864:[1]

Table of Paving Block Production.

Year	Thousand	Value
1887	10,000	$350,000
1888	10,500	367,500
1889	[2]7,303	297,236
1890	[3]7,000	245,000
1891	[3]5,000	150,000
1892	3,000	96,000
1893	2,900	92,800
1894	2,217	56,881
1895	2,136	67,808
1896	3,679	61,092
1897	1,295	28,035
1898	704	13,310
1899	200	3,780
1900	1,042	20,275
1901	1,690	32,675
1902	2,866	82,227
1903	3,879	80,492
1904	2,163	65,197
1905	2,145	66,785
1906	3,071	128,444
1907	2,698	112,797
1908	5,226	228,630
1909	3,006	134,223
1910	3,429	153,810
1911	3,278	162,892
1912	5,781	264,677
1913	2,761	126,747
Totals	98,969	$3,488,813

[1] Tenth U. S. Census Report, Vol. X, Pt. 3, pp. 97, 279.
[2] Eleventh U. S. Census, Report on Mineral Industries, p. 605.
[3] Estimated.

At a number of the quarries the spalls and waste from block-making operations are utilized for crushed rock for macadam and concrete work. In addition to the igneous rocks already mentioned, there is a tuff east of Freestone and sandstone along the coast from Fort Ross to Stewart's Point. The latter are undeveloped (R. X, p. 678; XI, p. 462; XII, p. 400; XIII, p. 638; Bull. 38, p. 141).

Aguillon Quarry, C. Aguillon, owner. It is ½ mile north of Sonoma, djoining the Vallejo Estate. Idle.

Bibl.: Bull. 38, p. 162.

Annadel Quarry (see *Hutchinson*).

Bacigalupi Ranch (*Norris;* also *Roy Bert*), N. Bacigalupi, Santa Rosa, owner. On this place in Rincon Valley northeast of Santa Rosa, re several quarry pits (one formerly known as Norris quarry) from which paving blocks were made for several years. A few were made n the spring of 1913, but none shipped during the year.

Bibl.: Bull. 38, pp. 343, 344, 345.

Barbera Quarry, Antonio Barbera, R. R. No. 6, box 89, Santa Rosa, owner. This is a small quarry on the Rincon Valley road near ts junction with the Santa Rosa-Sonoma road, 2½ miles east of Santa Rosa. It is on land adjoining the vineyard of the same owner, who makes a few paving blocks a day, working at odd hours.

Barnes Quarry (see *Craig*).

Beason Quarry (see *Lichau*).

Boca Quarry. F. Boca et al., Glen Ellen, owners. This quarry, 1½ miles east of Glen Ellen, has been idle the past two years.

Bibl.: R. XII, p. 396; XIII, p. 634; Bull. 38, p. 343.

Borg Quarry (see *Hutchinson ranch*).

On the *H. Calleaud* place at Buena Vista, 2 miles east of Sonoma, some stone was being taken out in 1913 by J. Newman, of Napa, for the new county bridge at Shellville.

Carpenter Quarry (see Clough).

John Cassaretto, of 345 Berry street, San Francisco, takes gravel from Sonoma Slough below Sonoma by means of a suction dredge, working mainly during high tides. The gravel is loaded into barges or scow schooners and carried to San Francisco, where it is screened. The dredge has a capacity of 200 to 300 cubic yards per day.

City Improvement Company (see *Violetti*).

City Street Improvement Company (see McDonald).

Claasen Quarry. Mrs. J. P. Claasen, R. F. D., Petaluma, owner. This quarry, south of town and adjoining the Petaluma Rock Quarry, has been idle for several years.

Bibl.: Bull. 38, p. 326.

Clough Quarry (*Carpenter*). M. S. Clough and Mrs. Young, Petaluma, owners; L. Green, manager. It is on the west edge of Petaluma, and is operated intermittently by the county under lease for road metal. The rock is principally andesite, in part grading to basalt, and varying in color from red to black. There are two faces, at the newer one of which the leasers have a No. 3 Austin gyratory crusher and a 25 h.p. gasoline engine, both on portable frames. There is a bucket elevator to the bin, but no screens.

Clute Quarry (see *Titania*).

Cooney Quarry. J. Cooney, Petaluma, owner. It is 2 miles east of Penn Grove. Idle for several years past.

Bibl.: R. XII, p. 396; XIII, 634; Bull. 38, p. 343.

Photo No. 139. Coutts Bros.' paving block quarry, Kenwood, Sonoma County, California.

Coutts Bros. Quarry (one time called *Maroni*), Sonoma Farms Company (Grace Bros.), Santa Rosa, owners; J. L. Coutts & Company, Kenwood, lessees. This paving block quarry is 1¼ miles northeast from Kenwood station; elevation 800 feet (bar.). It is near the top of and partly encircles a steep hill, being visible from the valley for several miles around. (See photo No. 139.) The present portion of the quarry was opened up by Coutts Brothers in January, 1910, though Maroni had operated here some years previously. The rock, which is a hornblende andesite grading in places to a basalt, is mostly massive breaking into blocks 10 feet to 15 feet through. The quarry extends for about a quarter of a mile around the hill with faces up to 50 feet high. Up to July, 1913, they had 40 to 50 men at work, since when but 6 have been kept on.

Bibl.: R. XII, p. 397; XIII, p. 635.

Craig Quarry (formerly *Barnes*), D. N. Craig, Penn Grove, owner. The quarry is on a low rounded ridge 1½ miles northeast from Penn Grove; elevation 150 feet. The stone is a dark gray, medium grained basalt. with hornblende phenocrysts. There is considerable vesicular material. Principally curbing is made, though formerly a large number of paving blocks were turned out. The curbing blocks are 10 inches deep by 5 inches wide and 11 inches long (requiring 92 per running foot). The men are paid 9 cents per running foot for the making, and he blocks sell for 10½ cents per foot. The output is all sold in Petaluma. Two men were employed during 1913.

In addition to curbing, Craig also sells gravel to the county for road work, from Petaluma Creek on another part of the same ranch.

Bibl.: R. X, p. 678; XII, p. 396; XIII, p. 634; Bull. 38, p. 343.

Cronin Quarry (see *Petaluma Rock*).

Davis Quarry, Henry Davis et al., Penn Grove, owners. Two miles east of Penn Grove. Idle for 12 or 13 years.

Bibl.: R. XII, p. 397; XIII, p. 634; Bull. 38, p. 343.

Dickinson Quarry, northeast of Petaluma. Idle for some years.

Bibl.: R. XII, p. 397; XIII, p. 634; Bull. 38, p. 343.

Elliott Quarry (see *McDonald*).

Fairville Quarry and Gravel Company, A. W. Foster, Jr., Flood Building, San Francisco, manager. This quarry at Quarries post office on the Northwestern Pacific Railroad, near Fairville, was opened up in 1907, and for a time produced at the rate of 5000 cubic yards of crushed rock per month; but it has been idle since 1910 owing to high freight rates. The product sold for 75 cents per ton f. o. b. Quarries, either on cars or barges (via Sonoma Creek). The equipment includes a No. 5 McCully crusher and a No. 2 Austin, with an oil burning steam plant.

Flinn & Treacy (see *Hutchinson Ranch*).

Frugoli Quarry, G. Frugoli, owner. It is on the Rincon Valley road, 6 miles northeast of Santa Rosa. Paving blocks. Idle.

Bibl.: Bull. 38, p. 343.

Gravel for road work throughout the county is obtained at the most convenient nearby point, and is under the direction of each supervisor in his district. Along the Russian River it is taken out free, while on the creeks the land owners are paid 10 cents to 25 cents per load (about 2 cubic yards).

Gray Quarry, J. W. Gray, 208 Lincoln street, Santa Rosa, owner. This paving block quarry is on the Rincon Valley road, in Sec. 6, T. 7 N., R. 7 W., 3 miles northeast from Santa Rosa. Block making began here in 1908, and in the spring of 1913 there were 12 to 15 men at work. Later, however, the quarry was idle, but it is intended to resume with a few men.

Hardin Quarry, J. M. Hardin, Petaluma, owner. This paving block quarry east of Penn Grove has been idle 10 years.

Bibl.: R. XIII, p. 634; Bull. 38, p. 344.

Harney Quarry (see *Melitta*).

Hill Quarry, Mrs. Josephine Hill, and E. B. Hill, Petaluma, owners. There is a crushing plant at this quarry near Petaluma. Idle since 1911.

John Hugert, of Agua Caliente, has been working a small paving block quarry on the J. Bower ranch 3 miles east of Melitta. Idle in 1913.

Bibl.: Bull. 38, p. 344.

Hutchinson Ranch Quarries (*Borg, Oleson, Annadel, Flinn & Treacy*), Thomas Hutchinson, Santa Rosa, owner. There are several quarries on this property east of Santa Rosa. E. and J. B. Laurent, of Kenwood, are operators on the Annadel group, shipping via Annadel siding on the Southern Pacific Railroad; while Flinn & Treacy, of San Francisco, have the Borg or Oleson quarries, shipping from Oleson siding. The quarries are at an elevation of about 800 feet. There are 3850 acres in the property, of which about 1000 acres have stone suitable for quarrying. The rock is principally a dark gray andesite; but grading in part to a black, fine-grained basalt. There is also some vesicular material.

Borg first opened up the Oleson quarry about 1893. Flinn & Treacy bought 15 acres of this which they worked out and they are now operating on a royalty basis on the west end of the ranch. They made an average of over 250,000 blocks per year, for 12 years up to the beginning of 1913; but when visited (October, 1913) there were only three men employed.

Laurent Brothers have been working the Annadel quarries for about seven years, previous to which they were about 15 years on the Wymore property at Melitta. During 1912 they shipped 200,000 blocks per month for several months, but were idle in 1913.

Bibl.: R. X, p. 376; XI, p. 463; XII, p. 396; XIII, p. 634; Bull. 38, pp. 343, 344.

Kellas Quarry (see *McNeill*).

Laurent Brothers (see *Hutchinson Ranch*).

Lawndale Quarry (formerly *Stacy*), Lawndale Forward Movement Syndicate, owner; T. S. Fritz, president; M. B. Sheehan, secretary; home office, 346 Monadnock Building, San Francisco; post office, Kenwood. There are several quarry openings on this ranch, 3 miles northwest from Kenwood, some of which have been worked by leasers, and some by the company. Except for one lease with two men employed, they were idle the last half of 1913. Both andesite and basalt occur, the latter showing a little olivine. The present company took over the property in 1909, principally for the purpose of growing eucalyptus trees for wood and lumber. It is stated that up to 1913 they had planted 110,000 trees. The shipping point is Lawndale switch on the Southern Pacific Railroad.

Bibl.: R. XI, p. 463; XII, p. 397; XIII, p. 635; Bull. 38, p. 345.

Lichau Quarry (*Beason*), A. C. Lichau, owner; 4 miles northeast of Penn Grove. Idle for years.

Bibl.: Bull. 38, p. 344.

Lounibos Quarry (one time *Cady*), W. C. Booth, 2220 Ashby avenue, Berkeley, owner; John Newman, Napa, lessee. This quarry of trachytic tuff in Sec. 36, T. 6 N., R. 5 W., about a mile east of Agua Caliente, is operated intermittently. The lessee was taking out stone (October, 1913) for the new county bridge at Shellville south of Sonoma. Stone from this quarry is also employed for curbings and other uses in the cemetery at Sonoma. There is a black vitrophyre associated with this tuff. They are apparently from the same magma, but cooled at different rates. One large boulder was found showing both phases, and grading into each other. This vitrophyre is the "granite" referred to in Bull. 38, p. 376.

Bibl.: Bull. 38, p. 162.

Lynch Quarry, John Lynch, Petaluma, owner; 6 miles east of Petaluma near the Hardin ranch. Idle for years.

Bibl.: R. XIII, p. 634; Bull. 38, p. 344.

Madison Quarry, Hans Madison, R. R. No. 5, Box 196, Santa Rosa, owner. This is a small paving block quarry, 2 miles east of Santa Rosa, across the road from the Titania quarry; elevation 300 feet (bar.). The owner works it single-handed intermittently.

On the *Mahoney Brothers* place on the Two Rock road west of Petaluma small amounts of rock are taken out occasionally for road work. It is a partly disintegrated material.

H. C. Manuel formerly operated a paving block quarry under lease on the English and Burnett ranch at Kenwood, but is now leasing on the Vallejo Estate (q. v.) at Sonoma.

Bibl.: R. XII, p. 397; XIII, p. 634.

Maroni Quarry (see *Coutts;* also *Titania*).

McDonald Ranch Quarries, C. D. Barnett et al., 629 Fourth street, Santa Rosa, owners. These quarries are at and south of Baku switch, 2 miles east from Santa Rosa. They are among the oldest in the county, having been opened up by McDonald in 1880. Until the railroad was built down the Sonoma Valley, the blocks were hauled to Santa Rosa for shipment. The ''Elliott'' quarry is included in this group. The City Street Improvement Company operated these quarries from 1891 to 1913, when their lease expired. In October, 1913, they still had about half a million blocks at Baku siding waiting shipment. In 1906 they had 100 men at work, and in earlier years a greater number. C. Lawrence and J. Percy each have leases on small areas of the property and are making a few blocks (October, 1913). All told many millions of paving blocks have come from this property.

The quarry pits are in a low, flat-topped ridge, elevation 350 to 400 feet (bar.); and the rock is a dark gray andesite. Matthews & Company, under a lease, have put up a rock crushing plant of about 30 tons per day capacity to utilize the spalls and waste for macadam and concrete work. They have a 20 h.p. electric motor, 16″ x 24″ jaw crusher, revolving screen and bins for three sizes of product. Stone from this place was used in the following buildings in Santa Rosa: Northwestern Pacific Depot, St. Rose Church (1900), Carnegie Library (1903).

Bibl.: R. VIII, p. 635; X. p. 675; XII, p. 396; XIII, pp. 634, 635; Bull. 38, pp. 163, 343, 344, 345.

McNear's Quarry, McNear Company, Petaluma, owner. This is a small quarry at the north end of Main street. The rock is basalt, in part weathered and disintegrated, and a few loads are occasionally taken out for road work.

Bibl.: Bull. 38, p. 326.

McNeil Ranch Quarry (*Kellas; also Wilkinson*), F. Riebli et al., lessees. It is near Penn Grove. Idle in 1913.

Bibl.: R. XII, p. 397; XIII, p. 635; Bull. 38, p. 345.

On the *F. Meacham Ranch* on the Sebastopol road northwest of Petaluma, rock is occasionally obtained for road work. It is a somewhat soft and broken up material.

Bibl.: Bull. 38, p. 327.

Melani Quarry, Melani Estate, owner. It is a small quarry adjoining the Schocken quarries at Sonoma. Idle past ten years.

Bibl.: Bull. 38, p. 344.

Melitta Stone Quarries (*Wymore;* also *Harney*), C. C. Wymore, R. F. D. No. 5, Santa Rosa, owner; W. W. and G. H. Wymore, Anglo Building, San Francisco, lessees. This group of quarries is 1 mile south from Melitta, 6 miles east of Santa Rosa, at an elevation of 900 feet (bar.). These large cuts (see photo No. 142) are visible from Santa Rosa. Operations were first begun here about 1888 by the Laurent Brothers, who continued for 15 years, and the present lessees since then. During the 9 years to 1913 production was at an average rate of 100,000 blocks per month. Idle since April, 1913.

Photo No. 142. Paving blocks. Melitta (Wymore) stone quarry, Melitta, Sonoma County, California.

There is a gravity tramway of 3200 feet which delivers the paving blocks in side-tipping cars to bunkers at the railroad. The rock, which is a medium-grained, gray olivine basalt, occurs principally in the form of boulders, the result of concentric decomposition. On a field examination only it might be mistaken for a trachyte or an andesite, because of its light color and the fact that the olivines are largely altered; but the microscope shows it to be a basalt.

Bibl.: R. X, p. 676; XI, p. 463; XII, p. 397; XIII, p. 634; Bull. 38, p. 345.

Mt. Pisgah Quarry (see *Petaluma Rock*).

Natomas Consolidated of California (formerly *Schocken*), Natomas Consolidated of California, Alaska Commercial Building, San Francisco, owner. This quarry (or rather series of quarries) is on a steep hill ½ mile north of Sonoma; elevation 400-500 feet (U. S. G. S.); and was first opened up in 1876. In 1880 it was bought by S. Schocken who operated it up to 1909, when the present owners took it over. About 1888, an average of 100,000 paving blocks per month were shipped from here, with 60 men at work. Some curbing and small dimension building stone have also been produced. Only two men were working, October, 1913.

The rock is a gray andesite, some of it having abundant, white feldspar phenocrysts. The surface of the hill near the summit is extensively potholed, with openings from a few square feet to one over an acre in extent and with a 100-foot bank. It is stated that the Natomas bought the property as a source of supply for crushed rock, as the spall piles are numerous and extensive. This feature has not yet been developed. In the early days of this quarry before the advent of the railroad, the paving blocks were hauled in wagons to the Embarcadero on Sonoma Creek, where they were loaded on barges.

Bibl.: R. VIII, p. 635; XI, p. 463; XII, p. 397; XIII, p. 635; Bull. 38, p. 345.

Norris Quarry (see *Bacigalupi*).

The *Northwestern Pacific Railroad Company*, has a gravel pit on the Russian River at McCray station north of Cloverdale. Some gravel for ballast was taken out in 1913.

Oleson Quarry (see *Hutchinson Ranch*).

Pedroncelli Quarry, F. Pedroncelli, owner. It is near Kenwood, but has not been worked for a number of years.

Bibl.: Bull. 38, p. 344.

Petaluma and Santa Rosa Electric Railway Company (see *Stony Point*).

Petaluma Municipal Rock Crusher, Conway Brothers, Petaluma, owners; City of Petaluma, lessee. This quarry near the west end of B street, was opened up and equipped by the city in January, 1910, under lease, with privilege of removing plant at termination of lease. The ock, which is a black, close-grained basalt with some olivine and augite henocrysts, occurs somewhat fractured, producing angular blocks p to three feet across. The quarry is worked only during the summer onths. The product is screened to No. 1, No. 2, and No. 3 sizes and 'dust.'' Electric power is used.

The following is an extract from the report of F. B. Singley, city uditor of Petaluma, for the fiscal year 1912-1913:

"The rock crusher account from the beginning (January, 1910) to June 30, 1913. ummary as follows:

DEBIT.

Plant and tools to June 30, 1913		$11,458 75
Operating expenses to June 30, 1913—		
Labor	16,637 25	
Supplies	3,398 32	
Power	1,192 05	
Royalty	1,654 21	
Sundries	599 64	
Total	$23,481 47	

CREDIT.

Crushed rock sold to June 30, 1913, 22,387.4 cubic yards for	$22,124 96
	$1,356 51

"Against this adverse balance of $1,356.51 in the operating expenses: The city as used on her streets 5,009.2 yards; and there were in the bunkers June 30, 1913, 30 yards; a total of rock crushed, 27,876.6 yards; which cost exclusive of the plant, 4¼ cents per yard.

"The 22,387.4 yards sold brought 98⅘ cents per yard; and the total used by the ty and on hand of 5,489.2 yards, cost the city $1,356.51, or 24¾ cents per yard, xclusive of the plant.

"Previous to the installing of city crusher, the city and contractors paid $1.25 per ard for rock."

Petaluma Rock Quarry (*Cronin;* also *Mt. Pisgah*), P. Cronin, Petauma, owner; E. B. & A. L. Stone, 401 Phelan Building, San Francisco, ssees; F. L. Marty, superintendent at quarry. One time leased to nion Construction Company. This quarry in Sec. 3, T. 4 N., R. 7 V., 1½ miles south of Petaluma, was opened up in 1864 (10th U. S. ensus Report, Vol. X, Pt. 3, p. 279). It is at tidewater on Petaluma reek (one time called Rudesill's landing), and at McNear's spur on e Northwestern Pacific. The rock is basalt with fine, white feldspar henocrysts.

Previous to 1890 this quarry was worked for paving blocks, but at resent solely for crushed rock. In the quarry face the material is oveled to cars and trammed to the screen which takes out the clay; en by gravity tram (in balance) to crushers (see photo No. 164). rom this point a belt conveyor carries it to the revolving screen, four zes being made: $\frac{5}{16}$, ¾, 1¼, 2 inches. A 30 h.p. electric motor dump-car of 4 cubic yards capacity transfers the product to the various storage bins. The plant has a capacity of 7000 tons per month, and the bunkers will hold 2000 tons of rock.

A new quarry face was being started (October, 1913), at the crusher level, which will do away with the gravity tram above. Nine men were at work, but 28 are required when in full operation. This quarry in 1913 supplied rock for the State Highway near Ukiah.

Bibl.: R. V, p. 108; VI, Pt. I, p. 27; X, p. 678; XI, p. 463; XII, p. 397; XIII, p. 634; Bull. 38, p. 345; 10TH U. S. CENSUS REP. Vol. X, Pt. III, pp. 97, 279.

Photo No. 164. Plant at Petaluma Rock Quarry (E. B. & A. L. Stone Company), near Petaluma, Sonoma County, California.

Lorenz Pietzoli has a small paving block quarry near Gray's on th Rincon Valley road northeast of Santa Rosa, which he works single-handed.

Purrington Quarry, 1¾ miles southwest of Petaluma. Idle severa years, except for an occasional load.

Bibl.: Bull. 38, p. 327.

On the W. D. Reynolds property, 2 miles east of Santa Rosa is quarry equipped with a crushing plant, for a time leased by D. C Albers. Idle past two years.

A. Rigoni has a small paving block quarry, adjoining Frugoli, on the incon Valley road northeast of Santa Rosa.

Roberts Quarry, Mary E. Roberts, Penn Grove, owner. This is 2 iles east of Penn Grove, but has been idle since 1910. When last perated, two men worked about three years on curbing and paving locks.

Bibl.: R. XII, p. 397; XIII, p. 635; Bull. 38, p. 345.

Roblar Mining Company, J. A. Ronsheimer, Petaluma, president. arrett Hyatt, R. F. D., Petaluma, secretary. It is at Roblar station n the Petaluma and Santa Rosa Electric Railway, 11 miles north of etaluma; elevation 175 feet (bar.). There is a quartz vein here 12 15 feet wide, in serpentine; strike south of west, and dip north nearly ertical. It has been worked by open-cut and mill hole and by cham- ering. A cross-cut adit has been run in 300 feet, then drifts 300 feet est and 100 feet east. To the west, the vein appears to be cut off y a fault, and to the east it splits up into several small stringers. The artz is crushed with rolls, then sized with shaking screens to four zes: No. 5 mesh to No. 6; No. 6 to No. 10; No. 10 to No. 22; through o. 22. The three larger sizes are sold for chicken grit, and the fines r plaster work and to painters for sanding. This quartz is said to rry some small values in gold and copper.

hoto No. 155. Drag-line excavator of Russian River Gravel Company, Healdsburg, Sonoma County, California.

Roy Bert Quarry (see *Bacigalupi*).

Russian River Gravel Company, J. D. Grant, Williams Building, San rancisco, owner; J. F. Bailache, Healdsburg, superintendent. This ant is on a gravel bar on the Russian River ¼ mile east from Healdsburg station with which it is connected by a Northwestern Pacific spur track. The first plant was built in 1906 and the present enlarged one in October, 1911. A 3-cubic-yard drag-line scraper (see photo No. 155) raises the gravel to a revolving screen (1½-inch aperture), and the oversize is crushed.

The material is then hauled by cable in side-tipping cars to the upper plant where it is screened to "sand," "roofing" (¾-inch ring) and "rock" (¾-inch to 1½-inch). Electric power is used. The "roofing" sells for $1 per ton at the plant, and the "rock" at 35 cents. Railroad cars can be run directly to the lower bins as well as the upper plant. In 1913, they were supplying gravel for the State Highway between Healdsburg and Santa Rosa. The screening plant has a capacity to load eight railroad ballast cars per day. The gravel is made up of Coast Range rocks, principally quartz, chert and hard sandstone.

Santa Rosa Bank Quarry (see *Titania*).

Santa Rosa Basalt Rock Quarry (see *McDonald*).

Schocken Quarry (see *Natomas*).

Sonoma City Rock Crusher. The city of Sonoma owns this plant, which is situated on land leased for quarrying purposes from the Vallejo Estate, ½ mile north of Sonoma. It was built in 1910. There is a 30 h.p. electric motor, bucket elevator, jaw crusher and screen (3 sizes); capacity 50 to 75 yards per day. The plant is subleased to R. E. Murphy, who furnishes rock to the city for 85 cents per cubic yard. A royalty of 5 cents per cubic yard is paid the owner.

Stacy Quarry (see *Lawndale*).

Stone, E. B. and A. L. (see *Petaluma Rock*).

Stony Point Quarry. Petaluma and Santa Rosa Electric Railway Company, owner; E. M. Van Frank, president; E. T. McMurray, secretary; operating office, Petaluma. It is at Quarry Station, about halfway between Sebastopol and Petaluma; elevation 220 feet (bar.). The earliest settlers used this rock for fireplace construction, but it is now used only for ballast and road metal. The waste is used for fills. The rock is a light, greenish to yellow trachytic tuff. A 70 h.p. electric motor runs the plant and a No. 5 Allis-Chalmers gyratory crusher is used. There are no screens. It is operated principally in the summer with 18 to 20 men. Capacity 200 cubic yards per day.

Stone from this quarry was employed in the bank at Sebastopol and the Carnegie Library (1904) at Petaluma (see photo No. 163); also the front of the Phoenix Block on Main street, Petaluma, built in 1858 The copings of this oldest building still have sharp edges, and the structure has survived two earthquakes and a fire on both sides of it

Bibl.: R. XII, p. 405; Bull. 38, p. 163.

Swank Quarry (see *Titania*).

Titania Quarry (*Clute*; *Swank*; also "*Santa Rosa Bank*"). P. Maroni, 925 Ripley street, Santa Rosa, owner. This quarry, 2 miles ast of Santa Rosa, was first opened up in 1885 by Clute and, up to seven ears ago when the present owner took it over, produced only paving locks and building stone. At present, besides crushed rock, some curbng and small dimension stone for buildings are turned out. Stone for he La Rose Hotel in Santa Rosa came from this quarry. The rock is a lark gray andesite. A 25 h.p. gasoline engine is used and fourteen men are employed. The crushing plant has a daily capacity of 40 ubic yards. The crushed rock is sold at $1.60 per cubic yard in Santa Rosa and $1.10 at the plant. Gravel from Santa Rosa Creek on the same roperty is also sold by Maroni.

Photo No. 163. Carnegie Library, Petaluma, Sonoma County. Stone from Stony Point Quarry.

Bibl.: R. XII, p. 396; XIII, p. 634; Bull. 38, pp. 163, 345.

Union Construction Company (see *Petaluma Rock*).

Vallejo Estate Quarries. Mrs. L. V. Emparon, Sonoma, owner; H. C. Manuel, lessee. There are several quarry openings on this property ½ mile north of Sonoma. The series of rocks here shows all gradation tages from a fine-grained black basalt through andesite and vitrophyre o tuff. Paving blocks are made from the basalt by Manuel, who had October, 1913) seven men at work (previously 15 to 20); while the ther rocks have been used locally for building stone. As has already been noted, the city of Sonoma has a small rock crushing plant here to utilize the spalls from block-making.

Bibl.: R. XI, p. 462; XII, p. 405; Bull. 38, p. 164.

Violetti Quarry (*City Improvement Company*). Andrew Nelson, Sonoma avenue, Santa Rosa, owner. This paving block quarry near Melitta has been idle several years.

Bibl.: R. XII, p. 397; XIII, p. 635; Bull. 38, p. 343.

Weyl Quarry. Weyl Estate, owner. This is a small paving block quarry adjoining the Schocken property. Idle the past ten years.

Bibl.: R. XII, p. 397; XIII, p. 635; Bull. 38, p. 345.

Wilkinson Quarry (*see McNeill*).

Wymore Quarry (*see Melitta*).

SULPHUR.

Native sulphur occurs at The Geysers and near-by, but no commercial production has been made.

TRAVERTINE AND ONYX.

(See *Healdsburg Marble Company*, under *Magnesite*).

YOLO COUNTY.

Field Work in September, 1913.

Yolo County is one of the central California counties, with Colusa on its north, Sutter and Sacramento on the east, Solano on the south, Lake and Napa on the west. Its area is 1017 square miles. The Sacramento River is its eastern boundary line, and Putah Creek forms most of the southern line. Cache Creek enters the county at the northwestern corner, flowing across to the center of the eastern side where it joins the Sacramento River. Being one of the Sacramento Valley counties, Yolo's resources are principally agricultural. Like Colusa, Glenn and Solano, its mineral resources are largely confined to its western, hilly section. As will be noted from the Table of Mineral Production (see page 196), but two substances up to the present time have been subject to commercial development: quicksilver and sandstone. Their total value to date has been a little in excess of $600,000.

In addition to these minerals there are in the museum of the State Mining Bureau, from Yolo County, specimens of asbestos from the California quicksilver mine west of Rumsey; basalt from near Winters; ron from near Capay. There are also mineral springs, whose locations are noted under that head.

Yolo is one of only two counties of California's fifty-eight which reported no mineral production in 1912 and 1913.

Bibl.: R. X., pp. 773-794; Bull. 38, pp. 264, 360, 365.

BRICK.

To supply a local demand, bricks were for several years made in this county, utilizing clay from beds near Woodland, Winters and Capay, but not for over ten years past.

Bibl.: R. X., p. 791; Bull. 38, p. 259.

COAL.

Some small veins of coal have been found in the western part of T. 9 N., R. 2 W., and also farther north, but no commercial production has ever resulted.

Bibl.: R. X., p. 790.

GOLD.

At one time placer mining in a small way was carried on along both Cache and Putah creeks. Some low grade quartz is also reported o have been found, but no development of any consequence made.

Bibl.: R. X., p. 790.

YOLO COUNTY—Table of Mineral Production.

Year	Quicksilver		Sandstone		Miscellaneous and unapportioned
	Flasks	Value	Cubic feet	Value	
1873	*995	$79,928			
1874	3,000	315,540			
1875					
1876	965	42,460			
1877	1,516	56,547			
1878	1,640	53,956			
1879	1,110	33,134			
1880	422	13,082			
1881					
1882					
1883					
1884					
1885					
1886					
1887					
1888					
1889					
1890					
1891					
1892					
1893					
1894			2,500	$1,000	
1895			542	1,873	
1896			252	378	
1897					
1898			264	384	
1899			264	384	
1900			908	1,760	
1901			1,540	2,300	
1902			328	450	
1903			280	144	
1904			180	720	
1905			175	200	
1906			160	204	
1907			250	350	
1908			140	1,150	
1909					
1910					
1911					
1912					
1913					
Totals	9,648	$594,647	7,783	$11,297	

*Flasks of 76½ pounds.

Totals.

Quicksilver	$594,647
Sandstone	11,297
Total to end of 1913	$605,944

LIMESTONE.

A deposit of limestone is reported in Secs. 30 and 31, T. 10 N., R. 2 W., 3 miles south of Cadenassa Station, on land owned by E. M. Nash, of Saratoga.

MANGANESE.

Manganese is reported on the Nash ranch, 3 miles south of Cadenassa Station. E. M. Nash, Saratoga, owner.

MINERAL WATER.

There are a number of mineral springs in the hills of the western part of the county, but none of them have so far been utilized except locally. Among them the following may be noted:

A *saline* spring on the line between Secs. 25 and 26, T. 12 N., R. 5 W., near Reed mine, now owned by F. A. Kauffman, of San Francisco, as a cattle range.

On the *Smith Ranch,* 4 miles west of Guinda, is an excellent sulphur-iron-magnesia spring which is used privately; also two white sulphur springs not utilized. Dr. R. E. Smith, Sacramento, owner.

A soda spring on the *Scribner Ranch* near the Reed mine west of Rumsey.

A sulphur spring above Fiske Creek, on the Rumsey-Reed mine road.

Several sulphur springs on Putah Creek near Devil's Gate, west of Winters.

Bibl.: R. X., p. 793.

QUICKSILVER.

California Mine (see *Reed*).

Harrison Mine (see *Ruby*).

New England Mine (see *Ruby*).

Reed Mine (formerly the California). F. A. Kauffman, 110 Market street, San Francisco, owner. This mine at the junction of Secs. 23, 24, 25 and 26, T. 12 N., R. 5 W., was in its early history known as the California. It is first mentioned as operating in 1870, and appears in the producing list in 1873, with an output of 995 flasks of quicksilver. The J. B. Randol table (Report of State Mineralogist, Vol. IV, p. 336) credits the mine with a production of 5,653 flasks between 1876 and 1880. It has not been operated since that time, and the buildings have been destroyed by fire.* The ore carried is principally metacinnabarite. The property is now owned as part of a cattle range.

Bibl.: R. IV, pp. 261, 289, 336 (table); V, p. 95; VI, pt. I, pp. 122, 336; X, pp. 358, 793; XI, p. 68; XIII, p. 604; Bull. 27, p. 117; GEOL. SURV. OF CAL., Geol. Vol. II, p. 133; MIN. RES. W. OF ROCKY MTS., 1873, p. 10; 1874, p. 30; 1875, pp. 14, 174, 493.

Ruby Mine (also known as *Harrison* and *New England*). Mrs. Madge Harrison, Georgetown, owner. In Secs. 26 and 35, T. 12 N., R. 5 W., south of west from Rumsey. Idle for years.

Bibl.: R. XII, p. 363; XIII, p. 598; Bull. 27, p. 117; U. S. G. S. Mon. XIII, p. 283

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*Since the above was written, a small output of quicksilver has been reported for the year 1914.

STONE INDUSTRY.

Sandstone beds occur along the ridge near the western boundary of the county, but they have so far been developed commercially at only one point—at Devil's Gate on Putah Creek, west of Winters. Gravel for road work is obtained from the creek beds throughout the county, the owners of the land being paid a per load rate for the privilege. The Southern Pacific Railroad Company formerly took considerable gravel for ballast from Cache Creek near Capay.

Putah Creek Quarry. E. F. Searles, San Francisco, owner, in Sec. 29, T. 8 N., R. 2 W., 9 miles west of Winters. The Michael Building (1895) Woodland, and several in Winters, are constructed of stone from this quarry, but it has now been idle for some years. The rock is a blue-gray sandstone similar in appearance to the well-known Colusa sandstone found to the north of here, but a shade lighter in color.

Bibl.: R. X., pp. 791, 793; XIII, p. 638; Bull. 38, p. 146.

Sackett Quarry. Sackett Bros. owners. On the Sackett ranch, 5 miles west of Winters, there is a body of light-colored volcanic tuff which has been utilized locally for building purposes, but not recently.

Bibl.: R. X., p. 791; XIII, p. 640; Bull. 38, p. 164.

PART III.

The Counties of

Del Norte, Humboldt Mendocino

By F. L. LOWELL, Field Assistant.

INTRODUCTION.

The three counties presented herewith constitute the northernmost coast group, being at the northwest corner of the State and bordering on the Pacific Ocean. Until quite recently—in fact, subsequent to writing the body of this report—the only transportation connection Del Norte and Humboldt counties had with the rest of the world was by water, Eureka, Fort Bragg and Crescent City being the principal ports. The Northwestern Pacific Railroad has now been completed through to Eureka, giving all but the extreme northern section a direct rail route to San Francisco. A railroad connection to Crescent City is at present under construction from Grant's Pass, Oregon.

The principal industries of this district are lumbering, dairying and agriculture, the mineral output, except for Humboldt, being as yet small. The undeveloped mineral resources, however, are great, the exploitation of which is dependent mainly on improved transportation facilities.

Acknowledgment is here made of assistance rendered by the various owners of properties, both during the field work and in the subsequent preparation of this report.

DEL NORTE COUNTY.

Field Work in August, 1913.

BRIEF GEOLOGIC DESCRIPTION OF DEL NORTE, HUMBOLDT AND MENDOCINO COUNTIES.

In discussing the geology of this section of the Coast Ranges, one is confronted with the similarity of the character of the rocks of the different geological ages and the scarcity of fossils by which the different series of stratified rocks may be distinguished. The rocks of the different formations have undergone such metamorphism that it is at times difficult to detect the change from one series to another. The Coast Range has been subject to so much disturbance that the rock masses have been crushed and faulted out of their original stratigraphic positions.

Beginning at the northern boundary of Sonoma County and extending north through Mendocino, Humboldt, and Del Norte counties, the geological structure is very regular. The rocks are mostly of Cretaceous age and are often very much altered. Serpentine, jaspers and mica slates are encountered in large quantities and in a very irregular manner. There are but few areas of unaltered strata.

The general strike of the axis of the Coast Ranges through these three counties is northwest and southeast and the preponderance of dip is toward the southwest, the crest of the range being nearer the eastern slope. The deep valleys have been eroded by the abundance of water and the level valleys of some of the watersheds contain strata of Pliocene age. These strata are shallow, and fossils have been noted in Del Norte and southern Humboldt counties. The Tertiary rocks are not as prevalent as those of the Cretaceous. The latter are to be noted more particularly in the oil field region of southwestern Humboldt County.

The South Fork of the Trinity River takes the same general northwest direction as the other rivers of the Coast Range. Trinity River changes its direction, flowing nearly west from Weaverville in Trinity County to where it joins the South Fork, thence northwest through the mountains to the coast. The Trinity Mountain range seems to be the joining strip uniting the main Sierras and the Coast Range. The rocks in this northern section become more crystalline, and the older granites which form the nucleus of the Sierras make their appearance. This granite outcrops north of Humboldt Bay and thence north to the state line.

From the junction of the Klamath and Trinity rivers, extending northward to the northern end of Del Norte County, the country is very rugged and covered with forests. The rocks resemble those of the Sierras and are auriferous and cupriferous. The gravels of the rivers also carry gold and platinum values. In this northern region, serpentine is the principal rock. Peridotite, the parent rock of serpentine, is found exposed by erosion on Horse Mountain in northeastern Humboldt County.

It might be said that the greater part of the geological formations of Mendocino, Humboldt and Del Norte counties is composed of sedimentary rocks of Tertiary and Cretaceous age. There does not appear to be a nucleus of igneous rock forming the axis of the range, although granite does outcrop in some parts of this section. There are remains of volcanic activity in the form of volcanic glass and tuff, and solfataric action is still taking place at some of the springs of southern Mendocino County.

Throughout Mendocino and southern Humboldt counties the Cretaceous sandstones are abundant, being very noticeable at Point Arena and in the oil section of southwestern Humboldt. Organic remains are absent except in a very few instances. The rocks of this age have been altered to a considerable extent and serpentines and mica slates are the alteration products.

In Del Norte County, granite forms the nucleus of the mountain ranges and over it is a mantle of metamorphic rocks. In the western portion of the country sedimentary rocks prevail. Intrusive serpentine carries the copper and chrome iron deposits. Quartz occurs in small seams and veins. Copper occurs in lenses of a rich concentration, either as free metal or in sulphides. The slates carry many thin seams of quartz, sometimes rich in gold, and no doubt the erosion of these formations is responsible for the gold concentrated in the streams.

This serpentine belt continues through Humboldt and Mendocino counties. Perhaps the most noticeable occurrence is at Horse Mountain, in Humboldt County. There the copper deposits in serpentine are encountered again. The country has been eroded so extensively that the older crystalline diorites protude through the more recent rock formations. Other acid rocks, such as quartzite, outcrop in large masses. besides a dike of porphyry which forms a well defined contact with serpentine. Not far from Horse Mountain on Willow Creek a large body of limestone is exposed, having a northwest strike. It resembles that in western Trinity County. Another limestone formation north of Humboldt Bay is well exposed. The granite formation also outcrops here.

Passing south through Humboldt County and across the redwood belt, the later formations of sandstone and shale come in. These carry the oil and gas of this section. The formation is very badly broken up and seepages of oil, and gas emanations are numerous. This formation continues into Mendocino County and is most noticeable on the coast at Point Arena. In the southern portion of Mendocino County, the amount of alteration by the introduction of magnesian combinations is noticeable. This is illustrated by the magnesite deposits and the mineral springs of that section.

Taking the three counties together, one might say that the geology is complex, the solution of which will take considerable time and much patience to decipher.

BLACK SANDS.

Almost all of the gold bearing gravels of the Smith River basin contain black sands which carry some platinum. The beach sands also carry values in gold and platinum. In cleaning up the sluice boxes of the hydraulic mines after the season's washing, these black sands are collected in large quantities and the platinum and gold content are found to vary greatly in their relative proportion to each other. On French Hill the platinum forms 5% of the total values. At Antone Kauss' mine on Craigh's Creek pieces of coarse platinum worth up to $25 have been found. On the Myrtle Creek Mining Company's property the black sands are said to assay as high as $3,562 per ton in gold and platinum.

Serpentine is a prominent rock formation in the Smith River basin, and being an alteration rock derived from peridotite which carries platinum, seems to bear out the theory of platinum deposits in the placer gravels.

Outside of these river gravels and sands the only other black sand deposit being worked in the county is on the beach 2 miles south of Crescent City.

Oro Del Norte Company. This company is incorporated for one million shares at a par value of $1 per share. The company owns 255 acres

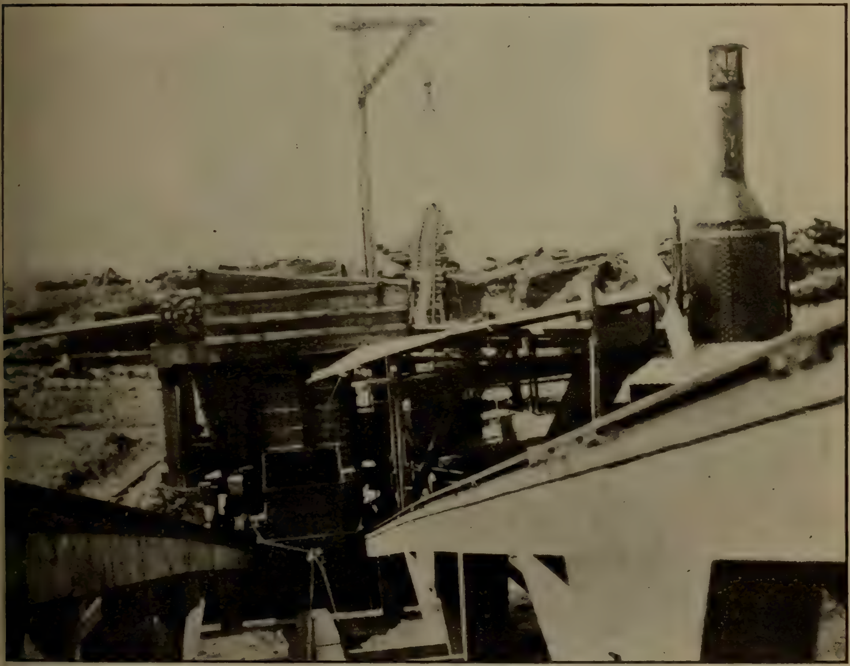
Oro Del Norte Black Sands Plant, showing method of hauling sands to bins on incline trestle.

Oro Del Norte Black Sands Plant, showing suction pipe line.

Oro Del Norte Black Sands Plant, showing the revolving screen.

of patented ranch land along the ocean beach 2 miles south of Crescent City. The plant is located just back of the driftwood line and consists of a suction pipe, skip conveyer to the plant, a large area of aluminum plates having riffles cut in them, a second area of small aluminum plates similar to the first, a third metal plate, the composition of which is not known, and an electrical equipment for charging the plates and other uses about the plant.

The company uses the Heintz electric flotation process for treating the sands for their gold and platinum content. The plant requires twenty-five men when in operation. Three shifts are worked and the electric power is developed by a 200 horsepower distillate engine. A change from the wood burning system to distillate was being made at the time I was at the plant. A larger suction pipe line was also being installed. The management claims that the new equipment will handle 800 yards of sand every twenty-four hours.



Oro Del Norte Black Sands Plant, showing sand skip and track for dumping waste.

The suction pipe is 5 inches in diameter and works on the ejector principle. The sand is delivered from the pipe line to a revolving screen which screens out all driftwood and large wash which is trammed o the water's edge and dumped. The sand from the screen falls to a bin from which it is drawn off to a 2-cubic yard skip and hauled up the ncline to the sand bins at the top of the treatment plant. Water is

Oro Del Norte Black Sands Plant at Crescent City, Del Norte County, California.

mixed with the sand in sufficient quantity to give it flowing properties. Four thousand gallons of water per minute is sufficient for all purposes about the plant, including the suction pipe line. The sand and water is allowed to flow over the metal riffle area at the same time an alternating current of electricity is passed through the metal plates. These plates have a grade of 2 inches to the foot and the magnetic iron which composes 30 to 50 per cent of the black sands is charged with electricity and repelled, leaving the gold and platinum in a concentrated condition. These plates are hosed off every half hour, the concentrates being washed into a sump from which they are pumped to a second set of aluminum plates of lesser area. These plates are charged with alternating current also but they are made more sensitive. The same process of elimination goes on here as before and these plates are washed off every hour and the concentrates, still further concentrated, go to a sump and are pumped over another metal plate, the composition of which could not be learned.

Oro Del Norte Black Sands Plant, showing the driftwood line.

This plate is supposed to remove the gold and platinum from the remaining heavy minerals. The precious metals are refined and returned as pure gold, platinum, iridium, osmium, etc.

This plant has cost $125,000, with the new equipment. Theodore R. Heintz, president and general manager; H. G. Stevenson, vice-president; and F. S. Markey, secretary. The main office is in the Merchants' Exchange Building, San Francisco.

BUILDING MATERIALS.

The local demand for building stone and brick is so small in the county that this industry has not been developed to any appreciable degree. A sandstone suitable for building purposes, and a clay suitable for making brick, are found 2 miles east of Crescent City. There is a good clay in Elk Valley, and Benjamin Howland is manufacturing brick. He supplies the local demand at $14 per thousand. There is also a deposit of good pottery clay in Elk Valley, owned by George Turner, but it is not developed.

COAL.

Small seams of lignite are found in some parts of the county, but the one locality which has received most attention is on the beach, about 3 miles north of Crescent City. There is an outcrop of what appears to be a tree partly converted to lignite. This tree can be plainly seen at low water. No vein has been found. A shaft was sunk to a vertical depth of 138 feet at a distance of 200 feet inland from the beach line, but no coal or lignite was encountered. It is reported that borings a thousand feet from the shore penetrated a vein that was 3 feet thick. Very little information was available about this discovery, and no development has been done.

CHROME IRON.

Chrome iron is fairly well represented in Del Norte County. There are several croppings in the Rattlesnake Mountains extending from the Bald Hills to the Klamath River. The deposits are in serpentine and are not being developed at this time. The two principal chrome iron deposits worked so far in the county are owned by the Tyson Mining Company, of Baltimore, Md.

French Hill Mines. These mines consist of two patented claims situated on French Hill, in Secs. 5 and 6, T. 16 N., R. 2 E., H. M., at an elevation of 1750 feet. The chromite is in the form of kidneys in serpentine. The deposit strikes northwest-southeast, and dips 60° NE. It is 8 feet thick at the point where the development has been done. One hundred fifty tons of ore are on the dump, and about 200 tons were shipped to Swansea some years ago and proclaimed excellent.

There is a wagon road 3 miles in length from the county road to the property. The mine is owned by the Tyson Mining Company, of Baltimore, Md. It has not been worked for some years.

Low Divide Mines. These mines, consisting of three patented claims are situated on Copper Creek, 1 mile from the old town of Alta, in Secs. 33, 34, and 35, T. 18 N., R. 1 E., and about 8 miles east of Smith River Corners, at an altitude of 1450 feet. The chromite is in serpentine. An open cut exposes the vein, which is 14 feet wide. There are about 500 tons of ore on the dump. This property is also owned by the Tyson Mining Company, of Baltimore, Md., but is not working now.

COPPER.

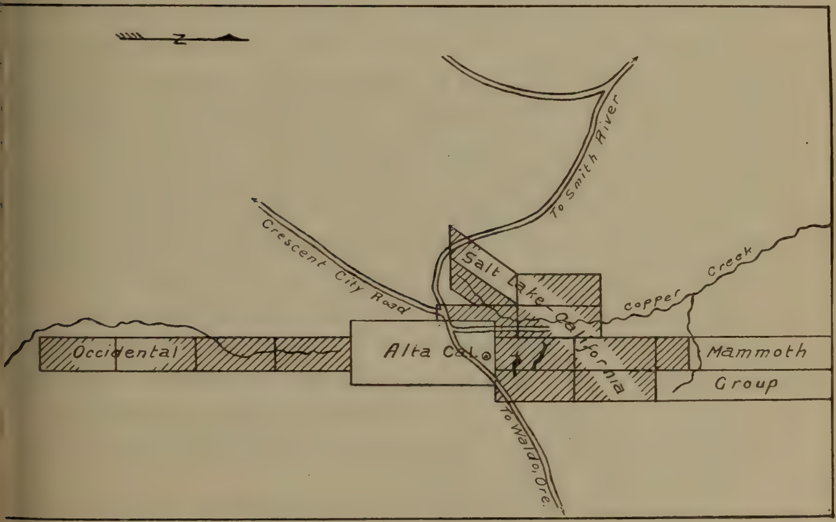
Del Norte County has several croppings of copper ore in its northern half, which extend easterly into Siskiyou County. The copper belt also extends southward along the eastern side of the county and on into Humboldt County.

As far as development in the past is concerned, the most prominent istricts are Low Divide in the Smith River basin, and the Dr. Rock istrict in the southeastern portion of the county. Many scattering rospects are also noted in other parts of the copper belt, such as that n Diamond Creek, a tributary of Smith River; Monumental District, nd also at French Hill.

The principal formation is serpentine, and the copper values are generally found in it or closely associated with it. Intrusive dikes of diorite nd peridotite are common. The copper lenses appear to be more stable here the acid rocks break through and also show a tendency to persist depth. The copper ore that has so far been worked, appears to be lenses of varying sizes and rich in copper glance, cuprite, melaconite, alachite, and native copper. The primary ore, chalcopyrite, is not so uch in evidence in the county. Between the years 1860 and 1870, opper ore was shipped from Del Norte to Swansea and also to Germany. he excessive cost of transportation and lack of roads throughout the ounty compelled the copper mines to close down until some future time hen a smelter will be within reach, or railroads are built into the ountry.

LOW DIVIDE MINING DISTRICT.

This district is in the Smith River basin and is the oldest copper amp in the county. It is situated at the head of Copper Creek, a ibutary of Rowdy Creek, at an altitude of 1780 feet. Between the ears 1860 and 1870 there was a prosperous mining town here with veral hundred inhabitants. There are only two buildings standing at

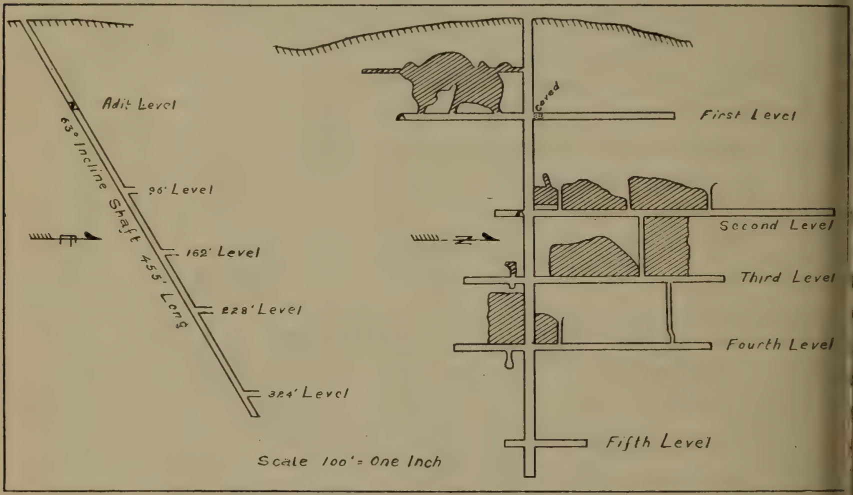


Low Divide Mining District, Del Norte County, California.

the present time, which are occupied by a caretaker of some of the properties. There is a wagon road from Smith River Corners, a distance of 9 miles, to the properties.

The formation is serpentine of a coarse texture and the strike of the vein on which most of the mines are located is north and south, having an easterly dip of from 35° to 65°. The vein swells and pinches along its length, forming lenses. The ores consist of chalcocite, bornite, chalcopyrite and some pyrrhotite.

Alta California Mine. This mine is owned by the Alta California Mining Company, with offices at 519 California street, San Francisco The mine consists of two patented claims and these, taken with the Occi-



Alta California Mine, Low Divide, Del Norte County, Cal.

dental group of four claims which immediately join the Alta on th south, were bonded to the Salt Lake-California Copper Company, formerly known as the Union Copper Company.

Between the years 1860 and 1870 the mine was operated through a incline shaft 455 feet deep and inclined 63° E. This shaft was serve by a steam hoist and an air compressor, but no equipment remains Eight hundred ninety-five feet of drifting has been done on the fou levels. The ore was shipped to Swansea and to Germany. These mine have been closed down for many years. The mouth of the shaft ha caved. From old records it is shown that ores carrying values of 15% to 18% copper were taken out. Ore averaging 11% was being taken ou when the mine closed down. Records of the shipments sent to Swanse show returns of $41 to $102 per ton.

Salt Lake-California Mine. This property was formerly known as th Union copper mine, and is owned by the Salt Lake-California Coppe Company, of Salt Lake City, Utah. It joins the Alta on the north an onsists of ten claims. Three of these claims, the Union Nos. 1, 2 and 3, re on the extension of the Alta vein. Not far from the Alta north end ne there is a strong outcrop of gossan carrying sulphides. This gossan xtends the entire length of the two claims and fraction of 3600 feet. his has been exposed in several cuts, and oxides assaying 25% copper ere found. There is a 60-foot tunnel and another tunnel 300 feet, both riven across the formation in an easterly direction. From the latter unnel a drift 100 feet in length was run south and a raise made. A hird tunnel further north is 450 feet in length and cuts the vein at that istance. There is a 100-foot drift south from this tunnel on the vein. 60-foot winze was sunk from this drift. From the bottom of the winze drift runs south 200 feet; and 17% copper ore was reported. This as the last work done before the mine closed down. A north drift runs om this same winze and is 240 feet in length. The 450-foot tunnel has een extended 200 feet to cut the east vein, but did not reach it. On nion No. 3 a vertical shaft 110 feet was sunk on the vein but no drift-g was done.

There is an adit level on the Big Bonanza claim, running east on an st and west vein. This vein is 3 feet wide. This level was extended far as 350 feet, with hopes of cutting the main north and south vein, ut it was not found. Sixty feet below this adit level on the same claim, 500-foot crosscut tunnel was run to intersect the north and south vein, ut failed to locate it. Most of the old workings are badly caved. The aft has caved near the surface. Four hundred tons of ore from the ove 60-foot winze were said to have averaged 18% in copper and .50 in gold per ton.

Superior Copper Mine. This mine was formerly known as the Atlantic acific copper mine, and covers the Mammoth group of fourteen claims hich join the Union mine on the north. The character of the vein is e same as that of the Salt Lake-California mine.

There are three tunnels on this property: No. 1, a crosscut, cutting e west vein; No. 2 is 150 feet below No. 1, and is also a crosscut, 700 et long. At a distance of 150 feet from the portal, a 4-foot vein of w-grade ore was cut which averaged about $20 per ton in copper, gold d silver. This tunnel failed to cut the main vein. A distance of 250 et above No. 1 tunnel, a third tunnel was run a distance of 500 feet, d cut a vein which was 2 feet wide. The vein pinched out, however, ter some ore was shipped from it. The mine has been shut down for me years.

Frank Zaar Copper Mine. This consists of four claims held by loca-on, the names being "Standard," formerly called Old Hanscom; Nome," formerly the Copper Queen; "Discovery," formerly Lady ll; and "A Beauty," formerly Copper Hill. The gossan is prominent these claims, 4 feet wide with serpentine walls. There is a crosscut tunnel on the Standard 500 feet long, which cuts a 4-foot vein carrying values in copper, gold and silver. From this tunnel there is a drift running southwest 50 feet and a drift northwest 50 feet long, also a winze 60 feet deep. Six hundred feet below No. 1 tunnel, a second crosscut tunnel was run 500 feet to cut the vein deeper but failed to do so. On the ''Nome'' there is a 28-foot vertical shaft on the vein and an open cut on an iron dike which is 18 feet wide. On ''Discovery'' a 50-foot vertical shaft was sunk. This is now caved. A crosscut tunnel 400-feet long failed to cut the vein. On ''A Beauty'' there is a 40-foot vertical shaft sunk on a 6-foot vein which assays 10% copper. Assessment work only is being done on these claims.

Idora Mine. This is only a prospect consisting of three claims situated 9 miles northwest from Low Divide, owned by William Ehrman, Yarbrough and Bricklin. Development consists of one crosscut tunnel 45 feet long, but has not reached the vein yet. There is a 30-foot incline shaft on the vein which is dipping 45° and is 3 feet wide. Five hundred feet along the vein has been stripped on the surface. Only assessment work has been done.

Oriental Copper Claim. There is only one claim held by location, and owned by E. R. Jenkins, of Crescent City. It is situated in the Low Divide mining district, at an elevation of 1900 feet. It has a 15-foot vertical shaft on a 4-foot vein. Only assessment work is being done.

DIAMOND CREEK DISTRICT.

Cleopatra Copper Claims. These claims are owned by James D. Lacey. There were formerly twenty-five claims held by location and known as the Dietrick group. Lacey lapsed in assessment work on all of the claims except one, which he retains. The claim is in T. 18 N., R. 2 E., H. M., at an altitude of 2600 feet, and is close to the California-Oregon line.

The claim was located in 1894, and is a contact vein with serpentine hanging and porphyry footwall. The strike is north and south and the dip 45° E. A 100-foot crosscut tunnel with a 40-foot north drift and a south drift of 80 feet. No. 2 crosscut tunnel is 180 feet long, and No. 3 crosscut tunnel is 130 feet long but did not cut the vein. About 200 tons of ore are on the dump but none has been shipped. Work ceased in 1911.

MONUMENTAL DISTRICT.

Hunters Luck Claims. There are six claims in this group, held by location since 1907. They are situated in T. 18 N., R. 3 E., at an altitude of 3100 feet, and owned by J. W. Ehrman and J. N. Britten. The vein is on the contact between serpentine hanging and porphyry footwall. There are two adit levels, the upper of which is 120 feet long.

'he vein as exposed in this level is 8 feet thick. The lower level is 160 eet long and the vein as exposed is 1 foot wide. The strike of the vein s north and south and the dip 50° E. Ehrman lives on the property nd is doing some development work. The ores are malachite, bornite nd chalcopyrite.

Britton No. 1 and No. 2. There are six claims in this group, held by ocation since 1904, situated on Patrick Creek at an elevation of 1950 eet. The vein is quartz carrying copper and gold, and the walls are ndesite. There are three crosscuts. The third is 340 feet long. There re 120 feet of drifts and a 60-foot winze. The strike of the vein is outhwest and northeast and dips 45° SE. Only assessment work is eing done.

Klondike Group. This group consists of Klondike Nos. 1 and 2, and even others located on Patrick Creek, 1 mile south of Monumental. They vere located by Luff & Duley, of Crescent City. The vein is quartz arrying marcasite and chalcopyrite, and is 4 feet wide. There are three unnels. Only assessment work is being done.

Lucky Boy and Rosebud. Property is composed of two claims held y location, the Lucky Boy since 1901, and the Rosebud since 1902. 'hey are situated in T. 18 N., R. 3 E., about ½ mile west of the county oad, and are owned by Otto Anderson. The vein is quartz carrying narcasite and chalcopyrite. There are three veins on the Lucky Boy, ll of which have cut the main vein, which is 4 feet wide in the upper vorkings. The strike of the vein is southwest and northeast, and its dip s southeast. There are two crosscut tunnels on the Rosebud, each 80 feet ong. One cuts the vein 17 feet from the portal, and the vein was 17 feet vide. The vein is quartz carrying heavy iron sulphides, not much opper, and very little gold. Only assessment work is being done.

Old Crow. Consists of four claims, namely, the Bowman, Morgan Vos. 1 and 2, and the Jumper, all held by location since 1910, and situted in the Monumental district at an altitude of 2800 feet. They are wned by George F. Morgan and Fred Bauman. There is a 2-foot chalopyrite-bearing quartz vein in porphyry. The strike of the vein is orth and south, and the dip 45° E. There are two crosscut tunnels, either one cutting the vein. Only assessment work is being done.

FRENCH HILL DISTRICT.

There are several copper prospects in this district that should be nentioned, namely—

Hendrix and Howe, consisting of five claims located in 1911, and wned by L. T. Hendrix and George W. Howe.

Hendrix, Howe & McDonald, consisting of five claims located on 'rench Hill, located in 1911, and owned by L. T. Hendrix, George W. Iowe and William McDonald.

Frank B. Edwards, prospect situated ½ mile east and 1 mile south of Mary Adams Station, in T. 17 N., R. 2 E. There is a tunnel 30 to 40 feet long. The ore is rich glance and carries values in gold and silver. Owned by Frank B. Edwards of Crescent City.

OTHER DISTRICTS.

Preston Peak Mine. This group consists of two patented claims, namely, the "Hobs" and "Copper Belt," located in 1891; and three unpatented claims, namely, the "Mountain King" and two others, located in 1891. All are situated in T. 17 N., R. 5 E., at an elevation of 4400 feet. They are owned by Charles A. Leib, G. W. Young, H. Mathey and others, of 20 Broad street, Boston, Mass. The mine is in the Siskiyou Forest Reserve, and reached by 5 miles of wagon road and 15 miles of trail from Waldo, Oregon. It became involved in legal difficulties and closed down in 1901.

The country rock is diorite and serpentine, and the vein is quartz carrying chalcopyrite, pyrite, and values in gold. The ore is in the form of a series of lenses, having a strike of about southwest and northeast, and stands almost vertical in the serpentine. The surface croppings have been proven up for a distance of 200 feet. The mine is opened by a crosscut tunnel 315 feet, and at a distance of 235 feet from the portal a 48-foot winze in ore all the way. There was also 37 feet of drifting done around the ore body, and 400 feet of drifting on the tunnel level looking for more ore, but only small kidneys were found. At 650 feet below the upper tunnel a second tunnel was run 55 feet in length, but the work was stopped. No ore was ever shipped. The mine has not been working for some years and the camp buildings have fallen to decay.

Doctor Rock Group. This group of copper claims, six in all, are situated in T. 13 N., R. 3 E., H. M., at the head of Blue Creek, and have been held since 1903. The altitude is 4475 feet. The property is owned by Mrs. F. C. Marlowe, Cordelius Thompson, A. J. Monroe and F. B. Faucett. The ore is quartz carrying chalcopyrite with slate footwall and serpentine hanging-wall. The strike is north and south and the dip uncertain. The croppings have been proven up for a distance of 800 feet. There is a 10-foot shaft on "Big Strike" claim and a 30-foot crosscut tunnel driven to cut this shaft failed of its purpose. There is a 37-foot adit level on the Doctor Rock claim. The ore carries values in gold and silver besides the copper. No ore was ever shipped and only assessment work is being done.

GOLD—PLACER.

Almost all the gold produced in the county comes from the placer mines of Smith River and its tributaries. The mines are mostly smal hydraulic properties where one or two small giants are used during the winter months. In some instances a common fire hose and nozzle is used on the gravel banks and the water, collected from the gulches in the rainy season, is stored in small reservoirs and piped to the gravel.

Aurora Hydraulic Mine. This property consists of two claims of 40 acres, located on French Hill, in T. 16 N., R. 1 E., at an elevation of 1600 feet and held by location since 1907 by Frank Lind, the owner. The gravel consists of high benches and the water supply is dependent on flood waters from the gulches collected in a small reservoir. A 6-inch canvas hose and a 1½-inch nozzle is used to conduct the water and wash the gravel. The gold is coarse. The mine is operated only during the winter months when there is plenty of flood water.

Doctor Young Hydraulic Mine. Consists of four claims adjoining J. M. Darnell's mine in the French Hill mining district in Sec. 32, T. 17 N., R. 2 E., and owned by Dr. W. S. S. Young. There is 1 mile of ditch bringing water under a 50-foot head to one No. 1 giant through a 7-inch pipe. Assessment work only is being done.

Dave Savoy Placer Mine. Consists of two claims in the French Hill mining district. The gravel is ground sluiced, the water being collected in a small reservoir. Owned by Dave Savoy and worked during the winter months.

Elkhorn Hydraulic Mine. The property consists of 2560 acres, mostly bonded, located at the mouth of Patrick Creek, in Sec. 16, T. 17 N., R. 3 E., and controlled by the Smith River Mining Company of Tacoma, Wash. The property is held by location since 1903 and is at an elevation of 1050 feet. There are 3 miles of flume which brings water to three No. 2 giants. There are two camps with accommodations for 25 to 30 men. Three men are now putting the flume in condition to wash this winter.

French Hill Placer Mine. Situated in the French Hill mining district, in Secs. 32 and 33, T. 17 N., R. 2 E., at an elevation of 1800 feet. There are nineteen claims, covering 380 acres, held by location since 1898 and owned by J. M. Darnell. The property is a bench mine and has 5 miles of ditch carrying 500 inches of water from Craigh Creek, and has a 150-foot face. Two No. 2 giants are used, and about 5% of the values are in platinum.

George Washington Placer Claims. These claims are situated on Monkey Creek adjoining the Elkhorn hydraulic mine, and taken together with the Monkey Creek mine, make 480 acres of gravel which have been bonded to the "Winnie Bob" Mining Company, capitalized for 1,000,000 shares in the State of Washington. The property is to be equipped with a hydraulic plant soon, but only assessment work is now being done.

George Cook Placer Mine. This mine consists of five claims located 3 miles south of Gasquet on the middle fork of Smith River. It has 4 miles of ditch and one No. 3 giant. The water is brought from Humboldt Flat watershed. During the winter months 300 to 400 miner's inches are obtained. The claims are not patented. Considerable coarse gold and some platinum is obtained.

Kaus Placer Mine. Situated in Craigh Creek mining district in Sec. 1, T. 16 N., R. 1 E., and owned by Antone Kaus. Two claims have been held by location for the last forty years. The gravel benches are ground-sluiced, the water coming through a $\frac{1}{4}$ mile ditch, giving a 30-foot fall. A 6-inch pipe and a 6-inch canvas hose bring the water to the gravel. A 2-inch nozzle is used. The gold and platinum are coarse, and worked during the winter months.

Myrtle Creek Hydraulic Mine. Situated in the Myrtle Creek mining district, in Secs. 3, 4 and 10, T. 16 N., R. 1 E., at an elevation of 260 feet, this mine is owned by the Myrtle Creek Placer Mining Company of Crescent City. The property consists of eighteen claims, or 360 acres. The gravel benches are washed by water taken from a $1\frac{1}{2}$-mile ditch, with a head of 75 feet. Eleven-inch pipe, with one No. 2 and one No. 3 giant, is used. The gold assays $18.50 to $19 per ounce. The black sands carry platinum in considerable quantity.

Monkey Creek Placer Mine. Situated in the Monkey Creek mining district and held by location since 1893, are seven claims owned by J. A. Haight and D. Haight. The gravel benches are ground-sluiced, the water coming through $1\frac{1}{2}$ miles of ditch from Monkey Creek. The dam has collapsed and no work outside of assessment work is now being done.

Nels Christensen Hydraulic Mine. This property is situated 300 yards from the forks of Smith River and consists of 34 acres of bench gravel, held by location since 1885 and owned by Nels Christensen of South Fork. There is a $1\frac{1}{2}$-mile ditch carrying 500 inches of water with a 75-foot fall through 9 and 12-inch pipe to a No. 2 giant.

Oak Flat and East Fork Groups. This property consists of 270 acres located in the Patrick Creek mining district at an elevation of 1430 feet, and is owned by a party of eight people (S. F. Raymond, D. E. Raymond, A. E. Newman, A. E. Newman, Jr., C. Newman, J. W. Ehrman, and Homer White). The mine consists of 270 acres of bench and creek gravels. Water is brought from Shelly and Patrick creeks through 3 miles of flume and ditch with a head of 650 feet. One No. 2 giant is used. The ditch is built for $1\frac{1}{4}$ miles and the remainder is now under construction.

Walter Crook Hydraulic Mine. This property adjoins Dave Savoy on French Hill in the French Hill mining district. It consists of three claims owned by Walter Crook and held by location. There is 1 mile of ditch taking water from Allen Gulch, a tributary of Craigh Creek, through a 7-inch pipe to a No. 1 giant. Worked during the winter months only.

GOLD—QUARTZ.

The output of gold from Del Norte County is due entirely to the placer mines, the production from the quartz mines being nil. Most of the ores from the quartz veins of the county are base and require concentration and shipment. The transportation facilities are so poor that development of quartz properties is hindered. Only assessment work is being done on such prospects at present.

Black Diamond Gold Quartz Mine. This mine is at an altitude of 6500 feet, and is nearly on the eastern boundary of the county, about 8 miles from the Doctor Rock mine. It consists of four claims located in T. 14 N., R. 4 E., H. M., and held by location by L. T. Hendrix. The vein, which is quartz, has a north and south strike and dips 70° E. Trap rock forms the hanging-wall, while the footwall is composed of shale. The ore is base and carries gold and silver values. The vein has been trenched, but no work further than assessment has been done.

Hard Luck Mine. This mine consists of six claims situated on Monkey Creek in the Monumental mining district and held by location since 1904 by J. N. Britton, of Waldo, Oregon. The vein is quartz carrying gold and arsenical sulphides. The development consists of two crosscut tunnels and 400 feet of drifts. Five tons of ore were shipped to the Selby smelter and are said to have assayed $10.40 per ton in gold. Only assessment work is being done.

Monumental Consolidated Quartz Mine. This property consists of eight claims of 165.28 acres, located in T. 18 N., R. 3 E., in the Monumental mining district, held by location since 1901 by the J. O. B. Gunn estate and Davis. The mine is at an elevation of 2560 feet. The vein is quartz, carrying specular iron with gold values and some copper. There is a 3-compartment vertical shaft 212 feet deep and an incline shaft to the 100-foot level from the other shaft. There is $\frac{3}{4}$ of a mile of drifts, an upraise from the 100-foot level to the surface and a winze from the 100-foot level. There are six prospect tunnels from 30 to 40 feet long. The ore is crushed in a Huntington mill and concentrated on a Frue vanner and Pender table, and the concentrates were formerly shipped to Selby. Power for the mill is furnished by water under 150-foot head through a 6-inch pipe acting on two Pelton wheels. The winding engine was run by steam and a Cameron shaft pump used to unwater the shaft. The camp consists of a store, bunkhouse, cookhouse, office, laboratory and barn, which are now in charge of a caretaker.

The mine has been closed down for several years and the camp is a convenient stopping place for travelers over the main highway from Oregon to Crescent City.

Ora Anna Quartz Mine. This property consists of one patented and three unpatented claims, owned by the Ora Anna Quartz Mining Company of Crescent City. It is situated in T. 16 N., R. 1 E., in the Bald Hills mining district, at an elevation of 1400 feet. There are two parallel veins between slate hanging-wall and hard porphyry footwall, and the vein filling is quartz carrying gold, both free and in the sulphides. The average width of the vein is 6 feet, and the strike is east and west, with a dip of 45° to the north. There is a tunnel 300 feet long from which a winze 70 feet deep has been sunk. There is an upper tunnel 40 feet in length. The equipment amounts to very little and one cabin remains on the property. Since 1897 only assessment work has been done.

Monumental Mine buildings at Monumental, Del Norte County, California.

QUICKSILVER.

Quicksilver in small quantities has been found in the northern part of the county in T. 18 N., R. 2 E., H. M., and also on Diamond Creek, a tributary of Smith River. Poor transportation facilities prevent development.

HUMBOLDT COUNTY.

Field Work in September, 1913.

BLACK SANDS.

In former years the black sands of the beach and bluffs of northern umboldt County were successfully worked at Upper and Lower Gold luffs, Big Lagoon, and Little River. The gold was fine and was saved y the use of the Oregon tom and ordinary tom and amalgamating lates. After a severe storm on the coast, the fine gold could plainly e seen concentrated on the beach in places. After the tide had eceded, pack mules were taken down and the sand packed away in acks for washing. Many thousands of dollars were taken out in this anner but for some reason the gold does not concentrate in paying uantities now and this method of collecting the sands has been bandoned. At Upper Gold Bluffs, a tunnel through the range of hills ividing Prairie Creek and the coast was cut one-half mile in length to ring water from Prairie Creek for washing the sands and gravels. The ocators of these beach claims became involved in litigation with locators f the land as timber claims and mining has been abandoned and the lant is in ruins. The sands and gravels of Klamath River carry a good ercentage of black sands having a gold and platinum content and ome of the hydraulic mines are losing considerable of their values, hich are carried away in the heavy gray and black sands which uickly clog the undercurrent riffles and cause an overflow of concenrates and values. They are desirous of finding a cheap method by hich these sands can be worked continuously in connection with the rdinary hydraulic operations, thereby not only saving the values but lso saving much lost time used up in clearing the riffles of the troubleome sands. Outside of the black sands encountered in the hydraulic iggings, there are no other sands that are being worked in the county t the present time. The gold and platinum are too fine and not in suffiient quantity to pay for working with the appliances available at resent.

BUILDING MATERIALS.

Brick and Tile. There are only two companies in Humboldt County ho manufacture brick or tile and they are able to supply the local and ounty demand. The Fortuna brickyard at Fortuna formerly owned y J. A. Thompson has been closed down and Mr. Thompson is now nterested in the Eureka Brick and Tile Company of Eureka.

Eureka Brick and Tile Company. John A. Thompson and John orter own four acres of clay land in the suburbs of the city of Eureka. he plant consists of one stiff mud brick and tile machine, one mixing machine, one grinding machine, one cut-off machine, one 70 horsepower engine, one boiler, one 300-barrel and one 100-barrel oil tank, water tank, scrapers and clay cars. Oil is used as fuel and the plant has a capacity of 25,000 brick per day. They make tile 3 to 12 inches in size and sell their brick at $10 per thousand at the plant. Tiling is sold at 2 cents per foot for 3-inch size up to 15 cents per foot for 12-inch size. This tile is used principally in land drainage.

Humboldt Clay Manufacturing Company. Lewis H. Hess, president, and W. Ernest Dickson, secretary, of Eureka. They own 1¾ acres of clay land adjoining the Eureka Brick and Tile Company in the suburbs of Eureka. The plant consists of one American Clay Machinery Company clay machine, one mixing machine, one disintegrator, one re-press, one cutoff machine, one 100 horsepower engine, two boilers, one oil tank (500 barrels). They sell the brick at $10 per 1000 at the yard and have a capacity of 25,000 brick per day.

There is an excellent blue clay on Jacoby Creek owned by J. A. Moore which is well adapted for the manufacture of brick. Nothing is being done with the clay at the present time.

QUARRIES.

The only quarries in the county are those being operated for the purpose of obtaining rock to be used in building the jetty at the mouth o Humboldt harbor and for road metal.

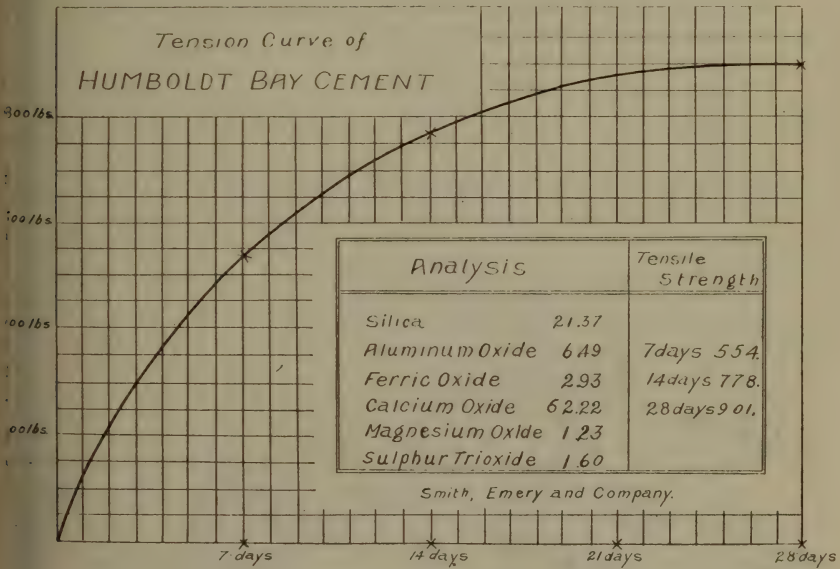
Haw Quarry. This quarry is owned by G. A. Dungan and I. M. Long, and is situated in Sec. 21, T. 5 N., R. 1 E., Humboldt meridian and 6 miles from Eureka, at an elevation of 150 feet. There are 70 acres. The rock is a basaltic lava termed tachylite (Lawson). Th plant consists of one mile of standard gauge railroad which connect with Humboldt Bay. There is one locomotive and eleven bottom dum cars, one barge, one tow boat, one air compressor, two Sullivan ai drills, one No. 3 gyratory crusher, one 12-foot screen, drill tools, etc The buildings consist of a cookhouse, blacksmith shop, powder hous and several smaller buildings. Electricity is purchased at 2 cents pe kilowatt hour. The capacity is 400 tons per ten hours. The rock i hauled by rail one mile to the bay and loaded on barges and towed t Eureka. The specific gravity of the rock is 3.169 and contains 42.7 pe cent silica. The rock is used for road metal and for filling.

Jacoby Creek Quarry. This quarry is leased by the Pacific Engineering and Construction Company of San Francisco, S. L. G. Knox, president. The quarry is 5 miles from Arcata and the equipment consists o 5 derricks, 90 cars, 3 barges and 1 tug, one 4-drill compressor, 4 compressed air drills, 1 drill sharpener, 2 hoisting cranes and the necessar drill steel. This company has the contract for furnishing the fill for th harbor jetty now being built. The rock is a meta-morphic sandston nd one quarry is a mica schist. This company is supplying the rock or the construction of the jetty at the entrance of Humboldt harbor.

Isaac Minor Quarry. This quarry consists of granite suitable for uilding purposes and is situated on Warren Creek which is a tributary f Mad River in T. 6 N., R. 1 E. Although the rock is suitable for uilding purposes, yet granite used in the county for such purposes as ıonuments is imported from other parts of California. There is so ttle construction going on in the county that requires a good building tone that the quarries, or rather the prospective quarries, have not een developed. The only rock being used at present is that used for oad metal and for the federal work on the harbor jetty.

CEMENT.

A cement manufactured from a limestone cropping on Jacoby Creek ı Secs. 13 and 14, T. 5 N., R. 1 E., on the property of the Bayside umber Company has been tested and an analysis made by Smith-mery & Company of San Francisco, and the following facts as shown y this tension curve, obtained:



Analysis		Tensile Strength
Silica	21.37	
Aluminum Oxide	6.49	7 days 554.
Ferric Oxide	2.93	14 days 778.
Calcium Oxide	62.22	28 days 901.
Magnesium Oxide	1.23	
Sulphur Trioxide	1.60	

LIMESTONE.

There is considerable limestone in the county suitable for burning or lime and also for fertilizer and smelter flux. The most accessible eposits to Humboldt Bay are on Jacoby Creek in Secs. 13 and 14, '. 5 N., R. 1 E., on the property of the Bayside Lumber Company. t is 3 miles from the bay and on the railroad. There is also another deposit on Jacoby Creek owned by J. A. Moore of Blue Lakes, Humboldt County. The analysis by the Miller & Brown Company of San Francisco gives the following results:

Analysis of Limestone from Jacoby Creek.

Received from State Mining Bureau, 1 piece of rock for analysis.
Sample found to contain the following:

Silica, SiO_2	1.41%
Lime, CaO 53.61%, $CaO.CO_2$	95.74
Iron oxide—Fe_2O_3	.35
Alumina—Al_2O_3	.56
Magnesia—MgO	Trace
Water	.01
Residue from carbonaceous matter	.50
	98.57

Volatile, CO_2, H_2O, etc. = 42.40 per cent.

There is a large dike of limestone crossing in a northwesterly direction from Trinity County to Humboldt County in T. 4 N., R. 5 E., which extends northwesterly and passes to the east of Horse Mountain and cuts across Willow Creek. This limestone formation has not been developed and is a source of immense quantities of good limestone.

There is also considerable limestone in the southeastern section of th county which has not been developed.

COPPER.

The copper belt of Humboldt County, as far as development to dat has proved, extends along the eastern part of the county, east of th redwood belt and extending from the southern end of Del Norte County south for the entire length of Humboldt County and over into th

Copper Croppings on the property of the Horse Mountain Copper Mine, Humboldt Count California.

parts of western Trinity County difficult of access. The copper of Humboldt County, like that of Del Norte County, is associated with serpentine. There are dikes of quartzite and diorite protruding through the serpentine in many instances and also the mother rock of serpentine, called peridotite, is encountered in a more or less altered condition.

The principal district where copper mining is being done at the present time is Horse Mountain, situated in T. 5 and 6 N., R. 4 E. The ore on the mountain seems to be of a secondary nature, consisting of bunches of impregnated serpentine close to the surface, in which the values run high in copper glance, bornite, native copper, and malachite. The general strike of the formation is northwest and southeast, with a dip to the northeast. The formation is mostly serpentine, porphyry and gabbro, the latter having peridotite closely associated with it, from the decomposition of which the serpentine is formed. Chrome iron is also encountered in small quantities in the serpentine.

Camp buildings of the Horse Mountain Copper Mining Company, on Horse Mountain, Humboldt County, California.

There are quartz and diorite dikes protruding through these formations all seeming to have a northwest and southeasterly direction and a northeast dip.

Next to Horse Mountain, the district where copper development has been done to a considerable extent is Red Cap Creek. Several Copper companies, namely the "Red Cap," "La Perin" have held claims on the ridge between Boise and Red Cap creeks and have done considerable work. Much rich copper ore has been found in the slides from the hills but the ore has never been found in place. No development is being done at the present time and the old tunnels have caved in and the buildings gone to ruin.

Nothing in the way of development is being done on Lassen Creek in T. 1 S., R. 4 E., or on the Rainbow or Crimson groups, in T. 1 S., R. 1 E., in the Mattole mining district.

Horse Mountain District.

Horse Mountain Copper Mine. This property consists of ten groups of claims, making 70 claims in all. They are unpatented and are situated on Horse Mountain in Secs. 33 and 34, T. 6 N., R. 4 E., and Secs. 3 and 4, T. 5 N., R. 4 E., at an altitude of 5000 feet. The property is owned by the Horse Mountain Copper Company, which is a

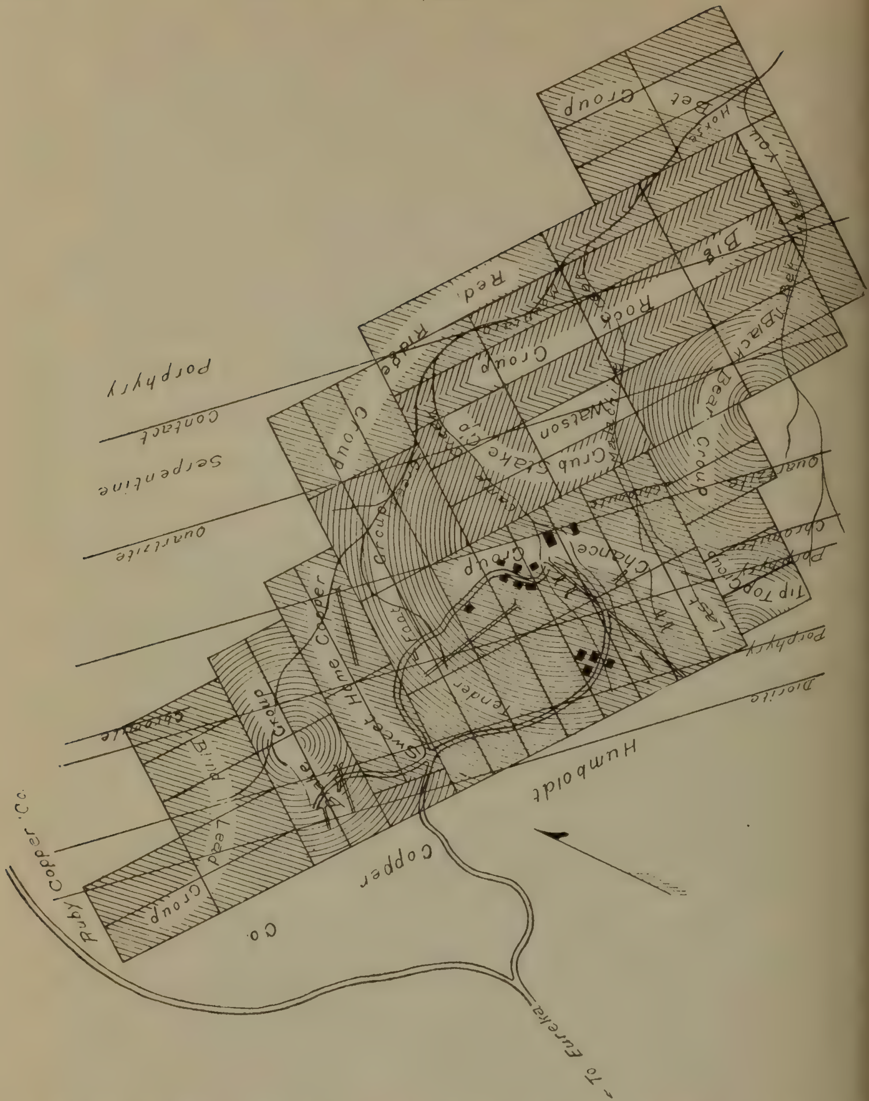
Mill of the Horse Mountain Copper Mine, Humboldt County, California.

stock company. The railroad from Eureka runs to within 25 miles of the mine and this distance is covered by a good wagon road. The original claims were located by Dave Wilson in 1907. The strike of the formation is northwest and southeast and dips about 40° NE. There are six crosscut tunnels and one adit level, also some open cuts. There is 3000 feet of underground development, mostly drifts and crosscuts. Steam supplies the power for the sawmill and two Huntington mills (one being 3½ and the other 5 feet). It also furnishes power for a Blake ore crusher, two Dodge secondary crushers, one Standard and one United concentrating table and two classifiers. Twenty-six men are employed underground and on the surface. Some concentrates have been shipped to Humboldt Bay but have not reached the smelter. The middlings are stored for future treatment. The concentrates average 20% copper and the middlings about ⅜% copper. The values in gold are about $4 per ton for the concentrates. A 16 h.p. Corliss distillate engine furnishes power for ventilating. Two 50 h.p. boilers, one 14 h.p. engine, one 20 h.p. engine and one 40 h.p. engine complete the power equipment.

The surface equipment consists of one sawmill with a capacity of 7000 feet, one blacksmith shop, one timber framing shop, barn, cookhouse, office, assay office, powder magazines and several bunk houses, making 35 buildings in all. Scraps from sawmill used for fuel.

Humboldt Copper Mine. This mine consists of eight claims or 160 acres, unpatented ground, which adjoins the Horse Mountain Copper mine on the southwest and lies in Secs. 28 and 29, T. 6 N., R. 4 E, and Secs. 32 and 33, T. 6 N., R. 4 E., at an altitude of 4800 feet. A wagon road is 25 miles from Korvel to the mine. The mine is owned by the Humboldt Copper Mining Company of Eureka, T. L. Loofbourrow, president, and Kenneth Newett, Jr., secretary. The original claims were located in 1905. The country rock is mostly serpentine with dikes of porphyritic diorite and granodiorite. The ores consist of chalcopyrite, chalcocite, cuprite, and free copper. The strike is northwest and southeast and the dip 45° to the northeast. The underground workings consist of three crosscut tunnels, 25, 100 and 700 feet, respectively. There are 750 feet of drifts, 20 feet of winze and 210 feet of raise. Assessment work only is being done and no ore has been shipped. The surface buildings consist of a cook house, bunk house and blacksmith shop.

Sweet Home Copper Mine. This property consists of eight claims of 160 acres of unpatented land adjoining the Horse Mountain mine and lies in Sec. 28, T. 6 N., R. 4 E., at an altitude of 4800 feet. The property is owned by the Sweet Home Mining Company of Eureka, E. P. Shier, president. A wagon road crosses the property and is within 1000 feet of the main workings. The ores are the same as those



Horse Mountain Copper Mining District, Humboldt County, California.

of the Horse Mountain mine. The strike is east and west and the dip 45° N. There are four crosscut tunnels and 230 feet of drifts. The company is doing assessment work only and some ore has been shipped for a test. The ores are chalcocite, bornite, cuprite and native copper. The surface equipment consists of a bunk house, cook house and a blacksmith shop.

Ruby Copper Mine. This property consists of thirty-eight claims or 760 acres of unpatented land situated to the northwest of the Horse Mountain Copper mine in Secs. 16, 21 and 28, T. 6 N., R. 4 E., at an altitude of 4500 feet. These claims are owned by the Ruby Copper Mining Company of Eureka, E. A. Walters, president, and Frank W.

Belcher, secretary. There is a wagon road to the mine. The original laims were located in 1907 and consist of the Blind Lead Group and he Ruby Group. Serpentine with dikes of porphyritic diorite and uartzite makes up the formation and the ores are the same as those f the Horse Mountain mine. The strike is northwest and southeast with a vertical dip. The underground workings consist of a crosscut unnel 510 feet long and 250 feet of drifting. A small 60-foot shaft rom the surface is also sunk.

The surface buildings consist of a cook house, bunk house, blacksmith hop, and a timber shed. The mine is in a developing stage and the res consist of chalcopyrite, cuprite, chalcocite, and bornite. There are also some black oxide ores and some gold values are obtained.

Mattole Mining District.

Rainbow Group. This copper prospect, consisting of nineteen claims, s located sixty miles south of Eureka in Secs. 19, 30 and 32, T. 1 S., R. 1 E., and also in Secs. 12 and 19, T. 1 S., R. 1 W. Several trenches have been cut across the vein matter and some carbonate ore has been pened up for several hundred feet along the strike of the croppings. No work has been done on this group of claims for some time.

Crimson Group. This group of copper claims, consisting of 80 acres f patented land, joins the Rainbow group of mines on the south, and s in Sec. 8, T. 2 S., R. 1 E. Several prospect holes have been sunk ver the 80 acres and carbonate ore has been found. No work has been done on the property for some years.

COAL.

There are indications of lignite seams in several parts of the county, ncluding the following places:

Maple Creek.
East branch of north fork of Eel River.
Near Mrs. Ray's house at Garberville.
Mad River.
Van Dusen River, two miles east of Hydesville.
Crogan Gulch, Maple Creek.
Buck Mountain Creek, near Garberville.

Coal is also found at the following places in the county:

On the east branch of the north fork of Eel River.
Ten miles from Garberville.
Jacoby Creek.
Two miles north of Arcata.
On the upper Mattole River.
On Larribee Creek.

Some of this coal has been burned in a blacksmith forge and found to be satisfactory. The seams, however, are not wide and this taken together with the cost of transportation and the cheapness of oil fuel, prohibits the development of these coal and lignite seams.

GOLD.

The gold production of Humboldt County is not large, being only $31,271 for the year 1912 (California State Mining Bureau Bulletin 65). This gold comes from the placer mines in the northeastern part of the county, on the Klamath River from the Hoopa Indian Reservation to the eastern county line and from the south end of the reservation southward along the Trinity River to the east line of the county. There are also two quartz mines that are being developed, but without any production as yet. One is on Red Cap Creek, which is a tributary of Klamath River, and the other is at the headwaters of Willow Creek, which is a tributary of Trinity River.

Red Cap Mine (quartz). Consists of ten quartz and three placer claims, all unpatented and owned by a stock company called the Red Cap Mining Company of Eureka, Humboldt County. The claims are located in Sec. 33, T. 10 N., R. 6 E., on the north fork of Red Cap Creek at an elevation of 2640 feet above sea level. These claims have been held since 1899. The country rock is porphyry with diorite dikes intersecting the formation. There are four veins being worked at the present time. The ore in the upper levels is free milling and in the lower levels it is a heavy sulphide carrying some copper. The strike is northeast and southwest and dips 70° to the northwest. There are three tunnels and 280 feet of drifts; also a 4-foot crosscut tunnel which is the lowest working tunnel and is only 45 feet in length. There are 100 feet of raises and 30 feet of winze. The mine equipment consists of the usual strap iron tunnel track, one ore car, blacksmith shop, hand steel, etc. The reduction equipment consists of a Gardner crusher, one Frue vanner concentrator, and amalgamating plates. There is also a wire aerial tramway from the upper tunnels to the ore bin at the crusher. The mine is only developing and no ore is being shipped.

Bonneyville Quartz Mine. Consists of six claims and a fraction of 130 acres of unpatented land owned by the Bonneyville Mining Company of Eureka, F. E. Peaslack, secretary, and Charles Helwig, president. The claims are located in Sec. 15, T. 6 N., R. 4 E., at the head of Willow Creek, which is a tributary of Trinity River, and at an elevation of 1640 feet. The claims have been held since 1912. The country rock is slate and porphyry. The veins are all in slate with the exception of one which is a contact vein, the contact being slate and porphyry. The strike of the formation is northwest and southeast and dips northeast about 30°. There are four adit levels with 15, 15, 20 and

375 feet of drifting done on them respectively. There are two cross-cuts, one 15 feet and one 35 feet, 375 feet of track of strap iron, one ore car and the necessary drill steel. There are two cabins on the property and a road was being built from the county road to the property. A water right of 300 inches also belongs to the property.

Little Klondike Mine. Consists of three placer claims and four quartz claims owned by F. Lubbs of Orleans, which adjoin the Red Cap mine at the head of Red Cap Creek. The quartz vein has prophyry walls and is very irregular in width. It frequently carries high values in free gold and in other places traces of copper are found. There is one mile of ditch and a cabin on the place. Only assessment work is being done.

Quartz Prospect on Pearch Creek. This prospect is on Pearch Creek, 2 miles from its mouth and 3 miles from Orleans. It consists of one claim on a vein which is 6 to 14 inches in width in schist formation. It carries free milling quartz which is crushed with an arrastra which is run by water power. The vein is inclined to be pockety and the gold is rather light, going $14 to the ounce. This prospect works in winter only.

GOLD—PLACER.

Placer mining in the county is confined to the Klamath and Trinity rivers, and the season varies from a few days (as in the case of the high gravel banks) to several months during the winter for the lower bars, where water can be ditched to the property.

Allen Mine (hydraulic). Consists of two unpatented claims owned by A. H. Allen of Orleans and located in Sec. 15, T. 10 N., R. 5 E., at the mouth of Red Cap Creek at an elevation of 460 feet. These claims have been held since 1898. They consist of bench gravels on a slate bedrock. There are 3.4 miles of ditch, 1000 feet of 11-inch pipe and one No. 2 giant served by 400 inches of water under a head of 80 feet. The gold is saved by block riffles, undercurrent and quicksilver. The mine works five months during the winter. The gold mints $17 per ounce and has platinum associated with it in small amounts.

Bondo Mine (hydraulic). Consists of two claims of 40 acres, formerly known as Croton Bar Mine and Markeson Mine, and owned by Morris Bondo of San Diego. The property is located in Sec. 29, T. 11 N., R. 6 E., on the Klamath River, 1½ miles up the river from Orleans. They consist of bench gravels, some of the gravel being cemented. The bedrock is rough slate, the strata standing on end. There are one mile of ditch and flume, 1400 feet of 22-inch, 18-inch, 15-inch and 11-inch pipe, two reservoirs and two No. 2 giants. There are 800 feet of sluice and the gold is saved by block riffles and quicksilver.

There are a house, blacksmith shop, barn, powder house and a derrick on the property. The gold mints $17.10 per ounce and the gold is about the size of wheat.

Cavanaugh Mine (hydraulic). Consists of one claim of 20 acres owned by C. A. Sample of 1202 I street, Fresno. It is located in Sec. 1, T. 9 N., R. 4 E., on the Klamath River, about 3 miles above Weitchpec, at an elevation of 550 feet. This claim was located in 1870 and has changed hands several times. The bedrock is an altered schist and the course of the channel is east and west. The property has 900 feet of ditch and brings 300 inches of water from Boulder Creek at a head of 90 feet. One No. 1 giant with 11-inch pipe is used. Block riffles with quicksilver and no undercurrent. The gold assays $18 per ounce. There are two houses, one blacksmith shop and a barn on the property. Work is done only during the winter months.

Clover Flat Placer Mine. Consists of 170 acres of patented mineral land and 173 acres of unpatented land owned by the Clover Flat Gold Mining Company of which F. E. Herrick is president and L. B. Campton is secretary. The mine is located in Secs. 17 and 20, T. 7 N., R. 5 E., on the Trinity River about one mile north of the village of Willow Creek (sometimes called China Flat) at an elevation of 675 feet. The claims were located in 1870 and worked most of the time up to 1912. The bedrock is slate and the course of the channel is north and south. The property has $2\frac{1}{2}$ miles of ditch which brings 2500 inches of water under a 175-foot pressure. The gravel is heavy wash. Block riffles, undercurrent and quicksilver are used for saving the gold. The equipment consists of 1000 feet of 22, 18, 15, 13 and 11-inch pipe, one No. 2 and one No. 3 giant, 400 feet of sluice, one reservoir covering an acre of ground and another reservoir a little less than an acre in area. A derrick is used for moving large boulders. The gold assays $18 per ounce. The gravels contain a large percentage of heavy black and gray sands, which cause considerable trouble in the riffles and undercurrent by clogging up and causing the gold to flow over. There is one third as much platinum as gold content. The mine has shut down until such time as some appliances are found for saving the gold and platinum contained in the heavy sands.

Florence Placer Mine. Consists of one claim of 20 acres of unpatented mineral land owned by J. E. Middlesworth and located in Sec. 31, T. 10 N., R. 5 E., on the Klamath River a little over 3 miles above Weitchpec, at an elevation of 570 feet. This claim was located in 1907 by J. E. Middlesworth, and has been worked ever since during the winter months. There is a good road to a point on the river opposite the mine. The bedrock is an altered schist. The gravel is a medium wash and the course of the channel is northeast and southwest. There re 340 feet of ditch which carries 300 inches of water at a 40-foot pres- re. Split riffles are used in saving the gold. A 7-inch pipe and nvas hose are used for conveying the water to a 2½-inch brass nozzle. he gold is scaly. It assays $18 per ounce. There is one cabin on e property and a pipe shed.

Klamath River Hydraulic Mine. Consists of fourteen claims or 280 res of unpatented mineral land formerly known as the A. D. Miller ine and owned by the Klamath River Mining Company. The mine is cated in Sec. 1, T. 9 N., R. 4 E., and Sec. 6, T. 9 N., R. 5 E., in e Weitchpec mining district and about 3 miles north of the village of eitchpec, on the Klamath River. The elevation is 550 feet. These aims have been held since 1860. Good roads to the mine from the ast, also from Orleans. There are two miles of flume which brings 00 inches of water under a pressure of 200 feet. The gravel benches ve a northeast and southwest direction and the bedrock is an altered hist. The gravel is a medium wash and carries no cement gravel. The aims were located in 1860. An 18-inch pipe serves a No. 4 giant and -inch pipe for a No. 3 giant. The present company has been operating r the past three years. The gold assays $18 per ounce.

Orcutt Hydraulic Mine. Consists of one claim called the Indian ack and owned by Ira Orcutt and located in Sec. 29, T. 11 N., . 6 E., in the Orleans mining district about 2 miles northeast of the wn of Orleans. The claim is unpatented and lies at an altitude of 0 feet. These claims were located in 1891 by Orcutt and have been orked every winter since. The bench gravels have a northeast and uthwest direction and the bedrock is slate. There is a ditch 3 miles ng that brings 500 inches of water under 150 feet pressure; 500 feet 11 and 9 inch pipe conducts the water to one No. 2 giant.

Orleans Bar (hydraulic). Consists of 1300 acres of patented mineral nd and about 600 acres of unpatented land owned by the California ining and Dredging Syndicate and located in Sec. 1, T. 10 N., . 5 E., Secs. 25 and 36, T. 11 N., R. 5 E., Secs. 30 and 31, T. 11 N., . 6 E., on the Klamath River at the town of Orleans at an altitude of 76 to 3300 feet above sea level. The years of location of the different aims are not given. The gravels are bench gravels, some being high nches and other low benches. There is a good road to the property, mpleted during the summer of 1912. The claims are on the Klamath orest Reserve, and the tailings are dumped into the river. There is report on the property made by H. DeC. Richards, E.M. Water brought from Camp Creek, Wilder Creek and other creeks and there re 10 miles of flumes and ditches which carry 2000 inches of water that n be delivered under a head of 400 feet. The course of the channel northeast and southwest and the bedrock is slate and serpentine.

The slate is stratified with quartz seams. The mine is equipped with reservoirs and also has 3000 feet of 18-inch and 11-inch pipe and four giants, namely, one No. 3, two No. 4 and one No. 5. There are two sawmills, four blacksmith shops, store, barn and two dwelling houses. There is also a machine shop with a complete equipment of tools.

Block riffles and undercurrent with quicksilver are used. The mine has not been working for one year. Thomas M. Logan is president; H. DeC. Richards, vice president and general manager; D. F. Hamon, secretary, and Dred T. Hale, superintendent.

Pearch Mine (hydraulic). Consists of two claims, patented, owned by P. L. Young and others of Orleans, and located in Sec. 32, T. 11 N., R. 6 E., about 1 mile northeast of the town of Orleans on the southeast bank of the Klamath River at an elevation of 537 feet. These claims were located about forty years ago by a man by the name of Pearch, and the names of the claims are John A. and Eli Pearch. They are on the Klamath Forest Reserve. There is a good road to the mine from Orleans. The course of the gravel channel is northeast and southwest and the gravel is a heavy wash with a little cement gravel. There are 1½ miles of ditch and flume which brings 1000 inches of water from Pearch Creek under a head of 170 feet. There are two reservoirs, 1000 feet of 22, 18, and 15-inch pipe, one No. 3 and one No. 4 giant. Eight hundred feet of sluice with block riffles and quicksilver are used to save the gold. There are two dwelling houses, a barn wagon-house and other small buildings on the property. This mine is in operation every winter.

Red Porphyry Mine (hydraulic). Consists of four and one half claims or 90 acres of unpatented mineral land owned by O. T. Crowe, B. F. Hiatt and others, and located in the Willow Creek mining district in Sec. 17, T. 7 N., R. 5 E., about 2 miles north of the village of Willow Creek on the west bank of the Trinity River. Claims located in 1899. A good road from Eureka crosses the mine. The elevation above sea level is 600 feet. The mine is on the Trinity Forest Reserve. There are two gravel channels having a north and south course, one bench being 900 feet long and the other about 1200 feet long. The bedrock is a black slate. Water is brought from Kirkham Creek in one mile of ditch and 500 feet of flume; 500 inches of water under 250-foot head, is used; 470 feet of 11-inch pipe and one No. 2 giant are used; 240 feet of sluice and 32 feet of undercurrent, block riffles and quicksilver are used. There are two buildings and a blacksmith shop on the property. The mine was not worked very extensively up to 1907, but since then it has been worked every winter. The gold is fine, assays $18 to $18.25 per ounce and has platinum associated with it.

Rocky Point Mine (hydraulic). Consists of three claims of 60 acres cated twenty years ago and unpatented. Owned by William Witt-ore and located in the Orleans mining district in Sec. 21, T. 11 N., 6 E., at an elevation of 500 feet. There is a wagon road to within miles of the property, which lies 3 miles northeast of Orleans the southeast bank of the Klamath River. They are in the Klamath orest Reserve. Water is brought from Wittmore Creek by one mile ditch and 300 inches of water at 150-foot pressure is delivered to e No. 2 giant by 600 feet of 9-inch pipe. The bedrock is slate and rpentine and the bench gravel has a northeast and southwest course. here are 200 feet of sluice, and block riffles and quicksilver are used r catching the gold. There is one house on the property. The mine orks during the winter months only.

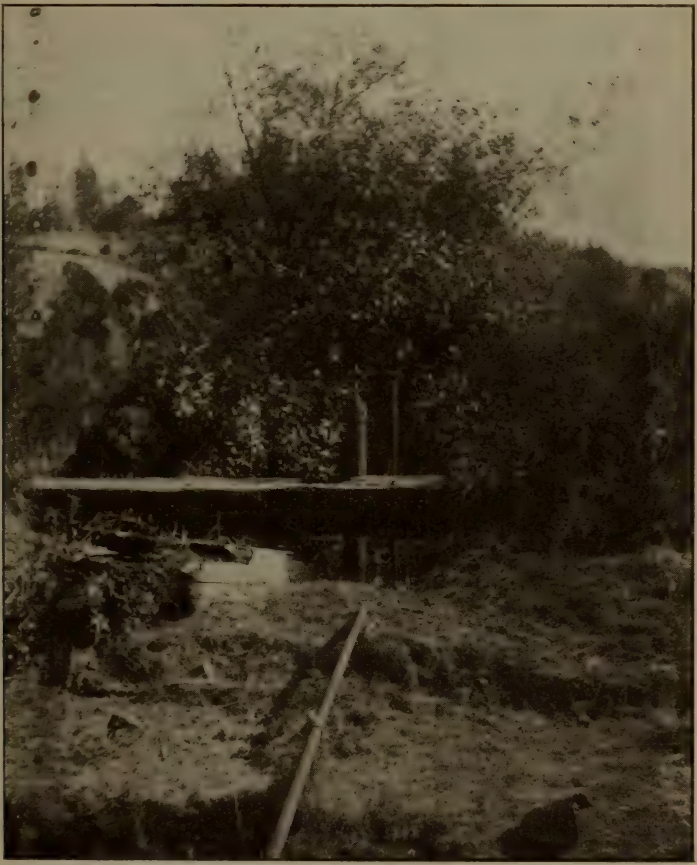
Rosalina Placer Mine (hydraulic). Consists of two unpatented aims owned by Lew Nelson and located in T. 11 N., R. 6 E., on the rthwest bank of the Klamath River about eight miles from Orleans trail at an altitude of 550 feet. These claims were located about venty years ago and are in the Klamath Forest Reserve. There are vo benches of gravel, both having a northeast and southwest course, d the bedrock is slate. There is ¼ of a mile of flume, one large servoir and 800 inches of water are brought to the mine under a 0-foot pressure through 200 feet of 21-inch pipe and 300 feet of 15 d 11-inch pipe. Two No. 2 giants are used. Block riffles with under-rrent and quicksilver are used for saving the gold. There are one ouse, a blacksmith shop, derrick and a barn on the property. The old is fine and flaky and assays $17 per ounce. A little platinum so accompanies the black sands. The mine works only three months the winter.

Rough and Ready Placer Mine (hydraulic). Consists of 40 acres unpatented mineral placer land, and 80 acres of patented land, rmerly known as the Rough and Ready Placer and the Sarvorum lacer groups, the former owned by A. R. Wilder and the latter owned A. R. Wilder, E. F. Wilder, B. H. Wilder, D. Wilder, and N. Wilder. hey are located in Secs. 1, 2, 11 and 12, T. 10 N., R. 5 E., in the rleans mining district, 3 miles southwest of Orleans on the south-ast bank of the Klamath River. The Sarvorum group of 80 acres is atented, while the remaining is unpatented. The Rough and Ready roup was located some time in the sixties and the Sarvorum group was cated in 1894. This property is at an altitude of 500 feet. The ravel benches have a northeast and southwest course and the bedrock slate. Water is brought to the property from Boise Creek and tribu-ries in 4¾ miles of ditch and flume, 100 inches being used under 0-foot head. The gravel is medium wash with large boulders on bedrock. There are 1000 feet of 11, 9, and 7-inch pipe, one No. 1 giant, 200 feet of sluice boxes, one barn, one small sawmill and several smaller buildings. The sawmill is run by water power generated by an undershot wheel. The gold assays $17 to $17.25 per ounce. Small spots of cemented gravel are found on bedrock. There is about 10 per cent loss in fine gold. The Rough and Ready group is about 300 feet above the river and the Sarvorum is about 60 feet above. The Sarvorum is used for ranching purposes now. The Rough and Ready is worked every winter.

Salstrom Placer Mine (hydraulic). Consists of five claims, none of which are patented. They are located in Sec. 1, T. 10 N., R. 5 E., and Sec. 36, T. 11 N., R. 5 E., 1¾ miles southeast of the town of Orleans, on the northwest bank of the Klamath River, at an altitude of 500 feet. They consist of gravel benches. The course of the channel is east and west. The bedrock is slate and the wash is large with large boulders on bedrock. The county road runs through the property. These claims are owned by Jonas Salstrom of Orleans. The property is in the Klamath Forest Reserve. Water is brought from Crawford Creek in ⅝ of a mile of flume; 800 inches under 185-foot pressure is delivered in 1500 feet of 24 and 15-inch pipe to one No. 2 and one No. 3 giant. These claims were located first in 1852 and relocated in 1890. One claim was located in 1910. Fourteen hundred feet of sluice boxes are used and block riffles with quicksilver are used to save the gold. There is a dwelling house, blacksmith shop, tool house, sawmill and barn on the place. The sawmill is run by water power. A small amount of platinum accompanies the gold. At the present time the mine can only work nine weeks during the winter months, on account of the scarcity of water. The gold is flaky and assays $17 per ounce.

Thompson Bar (hydraulic). Consists of four unpatented claims located in the Weitchpec mining district about halfway between Weitchpec and Orleans, on the northwest bank of the Klamath River, in Sec. 20, T. 10 N., R. 5 E., at an altitude of 650 feet. They are owned by William M. Salsbury, who located them in 1907. The county road passes on the opposite side of the river. The mine consists of bench gravels on a slate, serpentine and schist bedrock. The course of the channel is northeast and southwest. The gravel is small wash with large boulders on bedrock. Water is brought from three small creeks south of Red Cap Creek in 2½ miles of ditch and flume under 200 feet head. Three hundred inches are used. Hungarian riffles and quicksilver are used to save the gold. During the last three years no work in the way of washing has been done on account of the ditch being carried away frequently by the side hill sliding out. Eighty-four feet of sluice boxes carry the gravel into the river. The gold is flaky and assays $17 per ounce. No platinum contained in the gravel. There are 300 feet of 11-inch pipe from the ditch to the No. 2 giant.

Weitchpec Bar Mine (hydraulic). Consists of one unpatented claim of 20 acres located in the Weitchpec mining district at the village by that name in Sec. 10, T. 9 N., R. 4 E., at an elevation of 640 feet, and owned by J. C. Gist. The county road runs through the property. The bench gravels have a northwest and southeast direction and the bedrock is an altered schist. The gravel is medium size and loose. Water is taken from Weitchpec and Ben creeks and the Klamath River, 300 inches being brought to the mine in one mile of flume and ditch and under 125 feet pressure. There are 250 feet of 15-inch pipe and 1000 feet of 11-inch pipe, three giants, Nos. 1, 2, 3. One derrick for handling boulders, 250 feet of sluice boxes. Block riffles and quicksilver used to save the gold. There are a house and a barn on the mine. The gold is flaky. The mine works every winter and generally closes down the first of June. There is some platinum in the gravels.



Briceland Estate Gas Well at Briceland, Humboldt County, California.

NATURAL GAS.

As mentioned under oil, a gas suitable for illuminating and fuel purposes flows from some of the wells in the oil district of the county. There are many instances where gas is escaping from oil seepages, but only in two instances is the gas in sufficient quantity to be useful for domestic purposes.

Frank Peters Gas Well. There are three springs on Frank Peters' land in the village of Capetown in Sec. 13, T. 1 N., R. 3 W. The gas is tanked and used in the house for lighting and fuel purposes.

Briceland Estate Gas Well. A gas well is located on this estate at the town of Briceland in Sec. 18, T. 4 S., R. 3 E. The well is 780 feet deep and has $7\frac{5}{8}$-inch casing. The well is capped and the gas is drawn off by a 1-inch pipe for lighting the houses of the town of Briceland. No storage tank is used, consequently the pressure is rather low after a few hours' use.

GRAPHITE.

Graphite of an impure quality is found at Otto Rest on the South Fork of Trinity River on the line of the new state highway, also in T. 10 N., R. 4 E., and a little near the city of Eureka. No development has been done.

IRON.

Vivianite (phosphate of iron) is found on Maple Creek and also at Yager. Hematite boulders in large quantities are found on the ocean beach 4 miles south of Centerville. Soft red hematite also occurs on James Creek, 2 miles northeast of Arcata. No development is being carried on with these deposits.

MINERAL WATERS.

At the present writing no mineral water is shipped out of the county, although arrangements are being made to place the output of a new spring on the market in the near future. There are not many mineral springs in Humboldt County. Some years ago a spring was being used by the Humboldt Mineral Water Company. It was located at Flannigan's mill, 2 miles south of Eureka on the edge of the bay, and owned by the Bayside Lumber Company. The waters were bottled for local consumption until another firm began to bottle and charge the city water for local consumption.

The waters from the above mentioned spring contained the following ingredients:

Sodium chloride	32.91
Calcium carbonate	16.37
Magnesium carbonate	10.63
Sodium carbonate	2.45
Silica	1.32
Aluminum	.20
Iron oxide	.06

Traces of sulphates and organic matter and abundant carbonic acid.

Felt's Springs. These springs are situated on the side of the mountain, 1 mile west of Strongs Creek and 5½ miles northeast of Fortuna, in T. 3 N., R. 1. E., H. M. There are three sulphur springs close together, and at one time hotel accommodations could be had at the springs.

Waters contain the following minerals:

Sodium chloride
Sodium carbonate
Potassium chloride
Potassium carbonate
Potassium sulphate
Calcium carbonate
Magnesium chloride
Magnesium carbonate
Manganese
Traces of iron
Alumina
Silica.

Iagua Mineral Water. This spring is situated on the water front of the city of Eureka on the property of the Pacific Oil and Fuel Company. At one time the mineral water bubbled from the mud flats of the bay until a bulkhead was put in and the spring piped up to the level of the wharf. A pump is now used for securing the water and the spring is visited by many of the residents of the city. The Indians are supposed to have used the water years ago and the Indian name of "Iagua," meaning "Good morning," still clings to it. An analysis made by Professor William D. Johnson in 1885, gives the following ingredients:

One U. S. gallon	Contains in grains
Sodium chloride	1,403.00
Sodium carbonate	10.10
Sodium bromide	14.00
Potassium sulphate	12.20
Magnesium chloride	101.00
Magnesium sulphate	211.30
Calcium carbonate	3.80
Calcium sulphate	42.50
Alumina	1.30
Silica	0.95
Ferrous carbonate	0.12
Traces of manganese, boracic acid, iodine and lithium	1,800.27

There is carbonic acid gas in small amounts and the water is saturated with sulphuretted hydrogen. This mineral water is being placed on the market in San Francisco by George A. Knight, who owns the spring.

Cooks Springs. These springs are situated on North Yager Creek, 35 miles east of Eureka. They are sulphur and iron springs but have not been exploited.

Mountain View Spring. This spring is situated on Mad River, 28 miles from Eureka, and is a small spring smelling strongly of sulphuretted hydrogen.

Yager Creek Springs. They are located on the headwaters of Yager Creek on the ridge between it and Mad River. No improvements have been made on the property.

OIL.

Oil was known by the white man to exist in the southwestern portion of Humboldt County as early as 1860 and by the Indians even before this time. Oil was collected from seepages at times and used for supposed medicinal properties that it possessed. After the collapse of the oil boom in the eastern states in 1861 and 1862, people again began to make investments in oil. The people of California hoped to find an oil field in this State similar to that in Pennsylvania. Samples of oil were collected from the different seepages in the county, an oil boom started and many locations made. The town of Petrolia was laid out and times were good for a while. It was very difficult and expensive to transport supplies and machinery to the oil district, as roads were few and the steamers made their landing at Eureka and freight had to be shipped to the oil district by freight teams.

The principal oil field extended from the coast line at Capetown thence in a southeasterly direction to Garberville, on the south fork of Eel River, a distance of about 42 miles in length, and from the Rainbow ridge on the northeast to the Cooskie range on the southwest, a distance of 12 miles. This district may be divided into the Bear River district, which includes Bear River and its tributaries; the second or Lower Mattole River and lower north fork of Mattole River, and the third or the Upper Mattole River and upper north fork of Mattole River. The fourth district embraces the territory in the vicinity of Briceland and Garberville.

In the vicinity of Briceland the general strike of the formation is northwest and southeast. In some places the formational series of metamorphic gray sandstones and shales contain no fossils but are thought to be of Cretaceous age. In other places a series of sandstones and shales containing fossils of Neocene age are noted lying nononformably on the sandstone and shale of Cretaceous age. The retaceous rocks are lying at a fairly steep dip and, in places, carry etroleum and gas. There are numerous seepages of oil throughout he district, and oil can be gathered at these places in small quantities. as also is found escaping through the oil and water in these springs.

The oil in the Petrolia district is of a dark green color, while that f the Briceland district is more reddish in color. Both oils are of a araffine and olefine base with a specific gravity (at 64° F.) of 0.8229, hich is equal to 39.8° Baumé. It had a flash test of 73° F. and a ire test of 84° F. and has high burning qualities. The oils contain high percentage of paraffine wax and produce a fairly good quality f lubricating oil and a high grade cylinder oil.

Distillation percentages obtained from Humboldt County oils: 25.1 er cent engine distillate 50° gravity Baumé at 60° F.; 35.2 per cent ater white refined oil with fire test of 123° F.; 7.75 per cent white eutral oil at 35.5° gravity Baumé at 60° F.; 29.90 per cent lubricating il of 28° gravity Baumé at 60° F.

Union Well. Drilling for oil in Humboldt County began in the year 865 and, according to men familiar with oil development in the county, e first well was called the Union and was drilled in that year under he auspices of Hon. L. Stanford. This well was drilled in Sec. 30, . 1 S., R. 1 W. (all wells referred to the Humboldt meridian), and as 500 feet deep. It is reported to have been a 10 to 15-barrel well. he oil had to be pumped. For the log see the seventh report of the tate Mineralogist.

Brown and Knowles Well. This well is situated in Sec. 24, T. 1 S., . 2 W., on the north fork of the Mattole River. It was drilled to a pth of 300 feet, but no oil was obtained. No gas or water flowed from e well.

Henderson Well. This well was situated in Sec. 15, T. 1 S., R. 2 W., d was drilled to a depth of 500 feet. It was reported as a 10-barrel ell and had to be pumped.

McNutt Gulch Well. Situated in Sec. 30, T. 1 S., R. 1 W., and was wn 300 feet. It was drilled in 1865 and gave only a few barrels.

Burrows Well. This well was situated in Sec. 5, T. 2 S., R. 1 W., d was drilled by the Far West Oil Company in 1892 on Buckeye reek. At a depth of 500 feet, a flow of 5 barrels was obtained. At 0 feet, the string of tools was lost and the well was abandoned.

Davis Creek Well. This well is situated in Sec. 13, T. 1 S., R. 3 W., id was drilled in the year 1893 by the Far West Oil Company. Drill- g was continued to 800 feet, at which depth the casing was pulled and e well abandoned. Whether oil was obtained is not known.

Mackintosh Well. Situated in Sec. 29, T. 1 S., R. 2 E. It was drilled in 1902 to a depth of 1700 feet, and the flow is reported to have been 15 barrels of 45° gravity oil.

Craig Well. This well is situated in Sec. 30, T. 1 S., R. 1 W., and was drilled in 1902 to a depth of 700 feet. Another hole was put down to a depth of 800 feet, but the results were not satisfactory.

Wild Goose Wells. These wells are situated in Sec. 15, T. 1 S., R. 2 W., and were drilled in 1901 and 1902, one to a depth of 700 feet and the other to 1033 feet. No oil was obtained in the 700-foot well, but in the other oil was obtained at a depth of 221 feet. Oil sands 60 feet thick were passed through, and from these the drill passed into black shale. At 300 feet the water was shut off, and at 400 feet a small quantity of oil was obtained. The next 40 feet the formation was limestone, but a thin oil sand was struck at 441 feet. At 555 feet gas was encountered in large quantities sufficient to throw the string of tools from the casing. At 775 feet an oil sand yielded a flow of 15 to 20 barrels. At 1033 the string of tools was lost and the well abandoned. Water is now flowing from the well.

Humboldt Well. This well is situated in Sec. 6, T. 2 S., R. 1 W., and was drilled in 1901 and 1902 to a depth of 2000 feet. The formation was black shale all the way. Only a trace of oil was found at 120 feet, and the well was abandoned.

Hoaglin Well. This well is situated in Sec. 2, T. 3 S., R. 1 W., and was drilled in 1901 and 1902 by the Mattole Paraffine Company. It was drilled to a depth somewhere between 1700 and 1800 feet. Some oil at 1600 feet was obtained but the quantity could not be ascertained

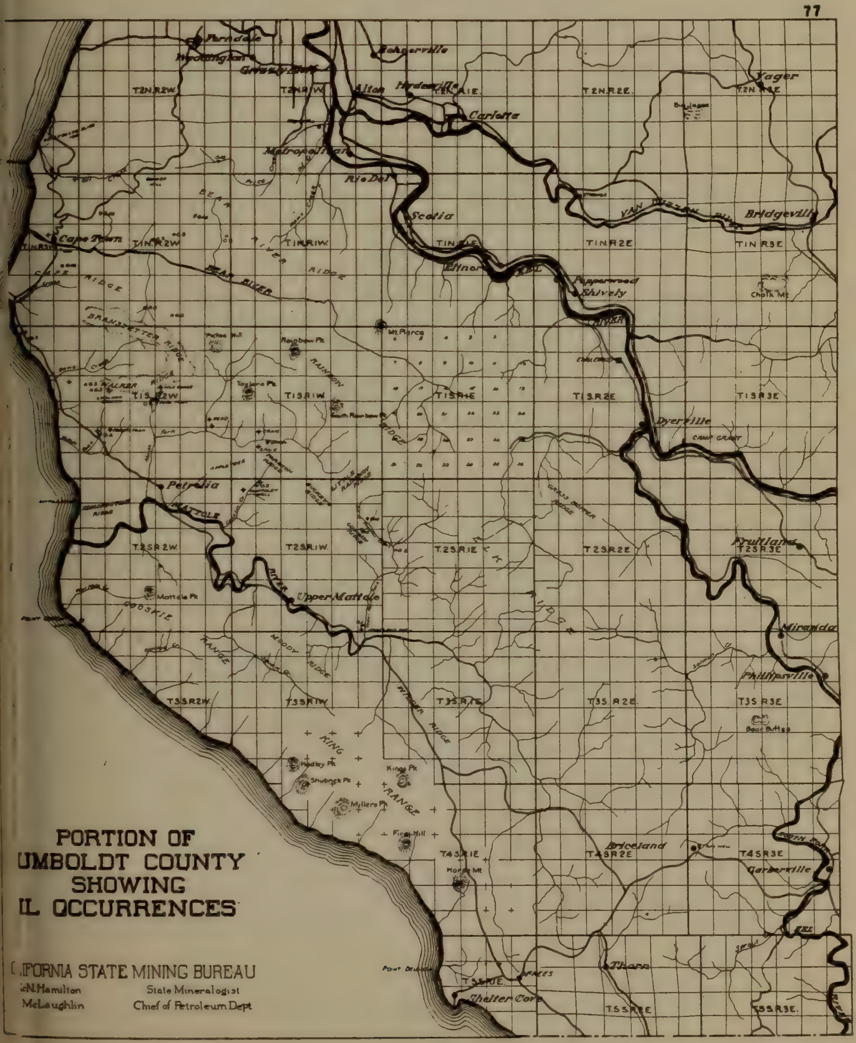
Reed Well. Located in Sec. 14, T. 1 S., R. 2 W., this well was drilled in 1901 and 1902 to a depth of 400 feet. Only gas was obtained. The company leased considerable land but did very little work.

Bear River Oil Wells. One well was drilled in Sec. 12, T. 1 N., R 3 W., close to the village of Capetown. Three wells were drilled in Sec. 16, T. 1 N., R. 2 W. The wells were drilled to a depth of a few hundred feet, but no oil was obtained, and the works were abandoned

Briceland Oil and Land Company's Well. This well is situated miles southeast of Garberville and was drilled to a depth of 2100 feet Oil sands at 410 feet were encountered carrying a little oil and at 50 feet the drill entered granite. The remaining 1597 feet of the wel were drilled in the granite formation. The well was abandoned.

There are many seepages of oil throughout the region, occurring a points of fracture in the formation, some being in the Mattole Rive and a number in the creek beds. The oil is light, and no doubt much of it has evaporated. Not being of an asphalt base, the dark stain i ot so apparent in the discoloration of the sandstone formation at these oints of seepage. On breaking the sandstone, the odor of petroleum ; very noticeable. Considering the broken condition of the sandstone nd shale formations, the amount of oil seeping from the fractures is ery small compared with other oil fields. The oil sands are rather hin so far as proven. This is also true of the oil-bearing shales of the istrict.

The wells drilled heretofore have not been located with any geological kill. Most of them have been drilled in close proximity to a fracture n the formation where oil was exuding. In other instances money



has been wasted in the drilling operations. The instance of a well being drilled in granite will serve to illustrate this point.

The dip of the formation is mostly to the northeast, but at Briceland there is a section of sandstone having a dip to the southwest. A company is now said to be organizing under the direction of Briceland people to drill in this formation. Aside from this, there is at present no activity in the oil district of the county. Many reasons for the failure to continue drilling in this field have been advanced, among them being the withdrawal of the land from sale and holding it as mineral land subject to entry as such. Taken together with expensive transportation and competition with cheap oil from Pennsylvania, these two causes are said to have been the reasons for quitting in 1867. However true this may be, it remains to be proven that there are wells in the district that are capable of producing oil in sufficient quantities to pay to work them commercially, even under favorable conditions. So far, only small producing wells have been found.

Bibl.: Report VII, pp. 195-200; VIII, p. 216; X, 207; XI, pp. 227-232; Bull. 19, pp. 161-166; Bull. 69, pp. 444-454.

OCHRE.

There are deposits of red ochre of good quality near Garbervill and also 8 miles from Ferndale. No development has been done.

MENDOCINO COUNTY.

Field Work in October, 1913.

BRICK AND TILE.

Brick and tile were manufactured at one time near the coast at the town of Mendocino and also at the county seat, Ukiah. Good clay deposits are available at these places but the demand for the product was not sufficient to make the business a profitable one, consequently the yards closed down. All brick and tile are now imported into the county from San Rafael by way of the California Northwestern Pacific Railroad.

COAL.

Lignite is found at several localities in the county, where it usually occurs in thin seams from a few inches to a foot in thickness. Three parallel beds of lignite traverse the county in a direction parallel to the coast line.

The most western bed lies 12 to 25 miles inland from the coast. There are croppings of this bed at Dooling's Canyon, Ackerman Creek near Ukiah, in Walker Valley 4 miles south of Willits, at the head of Ten Mile River, on Mill Creek and also in Humboldt County. This bed consists of small seams of coal of good quality but does not occur in payable quantities. Some of the coal will coke and some has been used n blacksmiths' forges with success.

The third bed lies 15 to 20 miles still farther inland and contains a vein of considerable thickness. The *principal* outcrop occurs on the middle fork of the Eel River near the mouth of Salt Creek and about miles from the railroad at the forks of South Fork and Middle Fork of Eel River. This bed of coal has been traced for a distance of 10 miles, ½ miles being on patented land owned by James Flood and 2½ miles on atented land owned by W. P. Thomas and associates, of Ukiah. Four r 5 miles of the croppings have been proved up, and, as far as develped, the vein appears to average about 16 feet in thickness. The bed egins in Sec. 9, T. 22 N., R. 13 W., and takes a southeast direction for 0 miles to Sec. 36, T. 21 N., R. 13 W., cutting across the middle fork of Eel River. The croppings on the river opposite Salt Creek have been eveloped to some extent and found to dip 31° northeast. The thickess at this point is 14 feet, with a seam of whitish slate 3 to 6 inches thick near the middle. The section of the formation here shows the following strata:

Top stratum not exposed.	
Blue clay shale weathering to small fragments	26 feet
Coal of good quality and luster	5 feet 6 inches
Soft white slate containing sulphate and carbonate of lime	3 inches
Coal of dull luster	8 feet
Sticky blue clay containing minute shells	21 feet
Some clay containing oyster shells	1 foot
Soft gray agglomerate containing clay, fragments of serpentine and sandstone	5 feet 6 inches
Soft greenish metamorphic sandstone	30 feet
Serpentine beneath.	

In a cliff, about 80 feet high which is about 1000 feet up the river, a hard greenish metamorphic rock is exposed, the strata of which seem to lie conformably upon the coal. About ½ mile north from the croppings and about 300 feet above the river several openings in the hill have been made and a tunnel said to be 400 feet long has been run on the vein in a direction of N. 10° E. About 50 feet of this tunnel is still open but the rest has caved. Sixty feet above the mouth of this tunnel, an incline shaft has been sunk on the dip of the vein to a depth of 30 feet. This shaft is in coal all the way, being 7 feet high, with coal exposed in both the roof and floor.

Below the coal bed and to the west of the workings a hard metamorphic sandstone is exposed but its position and thickness could not be judged. A few hundred feet east of these openings, metamorphic rock again occurs and rises in the form of a cliff 400′ to 500′ high, forming a sentinel rock for the surrounding country. It is to be noted that the coal occurs in a seam between the beds of highly metamorphosed rock without itself having undergone any great change in structure or composition.

Coal also outcrops about 1 mile southeast of the mouth of Salt Creek. The underlying stratum here is a white colored rock composed of a mass of broken shells and the strike is south 35° east. Still another mile up the creek, there is another outcrop on which some prospect holes have been sunk to prove up the seam. The coal has been traced northwesterly from the river and the same vein is supposed to extend into Round Valley. The coal along the Eel River appears to be of the Cretaceous age, while the coal of Round Valley appears to belong to the Tertiary period. The Round Valley coal is a bright, glistening variety with concoidal fracture. It contains little ash and a high percentage of carbons and stands transportation well.

The coal along this belt is no doubt a valuable asset to the county, and, now that transportation is within a reasonable distance, it remains to be seen if it can be mined and put on the market at a sufficiently low cost to compete with the present coals and petroleum.

LOUIS FALKENAU, State Assay Office, Safe Deposit Building, Room 16, southeast corner California and Montgomery streets.

No. 14,357. San Francisco, August 2, 1890.

J. L. FLOOD, Esq.,

Dear Sir: I have made a careful technical analysis of a sample of coal received from you marked "Eel River Coal Mine, Mendocino County," and a sample marked "Wellington," with the following results:

	Eel River	Wellington
Specific gravity	1.302	1.300
Moisture	7.9 per cent	2.4 per cent
Volatile combustible	36.2 per cent	33.45 per cent
Fixed carbon	53.5 per cent	58.6 per cent
Sulphur	0.4 per cent	0.15 per cent
Ashes	2 per cent	5.4 per cent

The cokes furnished by the two coals (sample of which I hand you with this report) are the same in appearance, but that of the Eel River coal contains 3.6 per cent of ashes, while that of the Wellington contains 8.4 per cent.

The Eel River coal weighs 81 pounds per cubic foot and in place 24.7 cubic feet will weigh a ton of 2000 pounds, but to store a ton, about 42 cubic feet will be required.

As the sample of Eel River coal is, according to your statement, from the surface exposed to extraneous moisture it is to be assumed that the coal at greater depth will contain much less moisture. If the Eel River and Wellington are both figured to dry coal, their carbon compares as follows:

	Eel River	Wellington
Volatile combustion	39.73 per cent	34.42 per cent
Fixed carbon	58.19 per cent	60.04 per cent
Total carbon	97.92 per cent	94.46 per cent

From the foregoing I consider sample of Eel River coal as equal to the Wellington for domestic use and as fuel for steam boilers.

Yours respectfully,

(Signed) LOUIS FALKENAU.

August 11, 1890.

Analysis of Two Samples of Coal for Geo. R. Wells, Esq.

	"A"	"B"
Water	6.70 per cent	2.55 per cent
Volatile carbonaceous matter	52.89 per cent	62.01 per cent
Fixed carbon	38.66 per cent	29.64 per cent
Ash	1.75 per cent	5.80 per cent
	100.00 per cent	100.00 per cent
Sulphur	2.49 per cent	1.81 per cent

The sulphur is present in the form of sulphates of lime.

By the combustion of two samples of coal of 1 pound each, the following quantities of water were evaporated:

Sample 1.—13.86 pounds. Sample 2.—12.8 pounds.

Both samples form a good soft coke.

THOMAS PRICE & SON.

STATE ASSAYER'S OFFICE.

San Francisco, December 8, 1870.

Analysis of coal from vein running through Eel River to Round Valley:

S. W. Glazier, Esq. (for the company),

Dear Sir: I have made a careful analysis of a specimen of coal received from you and have arrived at the following results:

Specific gravity	1.282
Volatile combustible substance	40.20 per cent
Fixed carbon	49.70 per cent
Moisture	6.70 per cent
Ashes	3.00 per cent
Sulphur	0.40 per cent

Amount of gas evolved, 37 cubic feet for 10 pounds Avd. of the coal.

The coal burns freely, yields a fire light and compact and sonorous coke, and its ashes are of a reddish-gray color and do not slag.

The amount of sulphur is so minute that it does not make itself perceptible to the smell in burning the coal.

Respectfully yours,

L. Falkenau, State Assayer.

COPPER.

Copper mining is dormant. There are several prospects where slight development has been done, but these workings have caved in and are practically abandoned. Among the prospects that have received some attention may be mentioned the following:

Eden Valley Copper Mine. This mine is sometimes called the Deep Hole copper mine and is situated in Sec. 13, T. 20 N., R. 12 W., M. D. M., in the Eden Valley mining district at an elevation of 2500 feet. It is owned by W. P. Thomas and associates of Ukiah. There are two claims, comprising 40 acres, located in 1900.

Three or four small veins from four inches to a foot in thickness strike northwest—southeast and dip 22° northeast. The veins are composed of quartz carrying chalcopyrite in one vein and carbonates in another. The ore averages about 10 per cent copper. The hanging-wall is a soft slate and the footwall is a quartzite. Two hundred feet of the vein has been proven on the surface. There is a 40-foot shaft which cuts three veins. No work has been done for the last seven years. A cabin, bunkhouse, blacksmith shop, and barn are on the property.

Native Copper Mine. This is a prospect situated in Lost Valley, and at one time owned by C. H. Staut of Ukiah. The only work that has been done consists of trenching. It has been idle for some years. The native copper is disseminated throughout serpentine which is also the country rock in this vicinity.

Salinas Copper Mine. This prospect is also in serpentine formation in Lost Valley and the strike is northwest—southeast, and the dip 65° NE. Some sulphide ore was taken out. It was owned at one time by C. H. Staut, but has not been worked for some years.

Red Buck Mine. This property is an extension of the Salinas mine and the development work consists of a 35-foot tunnel and a 50-foot winze from it, all of which has caved and been abandoned.

Red Mountain Group. This group consists of four claims situated 10 miles southeast of Ukiah on the ridge which divides the waters of the Russian River and those of Clear Lake and Cache Creek. There are two veins, located in 1890 and relocated from time to time. The formation is serpentine. One claim is developed by an open cut and a crosscut tunnel. Several small bunches of ore have been found in the cut showing green carbonates and metallic copper. An adjoining claim is developed by two shafts, one 100 feet and the other 50 feet deep. In 1896, carbonate ore was taken out above the 50-foot level in one shaft, and the shaft was extended to the 100-foot point, but no ore was exposed, the bottom being in sandstone and clay. From an incline several tons of low grade ore have been taken out. The former owners were Huff & Gibson of Ukiah. No work has been done for some years.

Ogle Copper Mine. This mine is situated in Anderson Valley mining district in T. 13 N., R. 12 W., and consists of 2000 acres of patented land. It joins the Redwood Copper Queen mine on the north. A 16-foot shaft in the center of the claim exposed carbonate ore. Not enough work has been done to demonstrate the width of the vein. Gossan can be traced through this property for a distance of a mile. Ogle Brothers of Ornbaun were the former owners.

McGimpsey Mine. Situated in Secs. 13, 17 and 18, T. 13 N., R. 12 W. The property comprises eight claims in a serpentine formation. Considerable copper stain is shown in the open cuts and, in a few places, red oxide of copper mixed with oxide of iron is seen. The former owner was C. P. McGimpsey of Ukiah.

Pieta Mine. This prospect consists of only one claim and is located 10 miles northeast of Cloverdale and 4 miles north of the southern boundary of Mendocino County. There is a 55-foot open cut across the vein material which strikes east and west. It has not been worked for years. The ore carries a slight trace of carbonate of copper and the gangue material is mostly iron oxides. The walls are serpentine. The former owners were J. C. Caldwell and associates of Healdsburg, Sonoma County.

Redwood Copper Queen Mine. This property, consisting of 840 acres of patented land, located in Secs. 17 and 20, T. 12 N., R. 13 W., M. D. M. It is 25 miles by wagon road from Cloverdale, which is the nearest railroad station. The country rock is a highly altered sandstone covered with a thick layer of soil. There is a heavy growth of timber on the land. Gossan croppings appear at several places. Development work has shown a mineralized zone 300 feet long, 10 to 40 feet wide and 125 feet deep, carrying kidneys and lenses of sulphide ore the size of a man's fist and larger. The largest kidney found was 75 feet long and six feet thick. The ore is a heavy iron sulphide carrying copper up to 8% or 9% and small values in gold and silver.

During the year 1906, 400 tons of ore were shipped to the Peyton Chemical Company plant for treatment. Its high sulphur content and the absence of arsenic made it desirable for the manufacture of sulphuric acid. The company is a San Francisco corporation of which E. R. Leach is president, and Claude Mellersh, secretary.

CHROME IRON.

There is a deposit of chrome iron in Sec. 24, T. 15 N., R. 13 W., M. D. M., about one and one half miles west of Ukiah. Very little work has been done to develop this deposit.

Chrome iron has also been found 12 miles north of Willits.

GOLD.

There is no mining for gold in Mendocino County at the present time. In former years there was some development work being done on the Boy Edgar and Van Allen mines but only the ever-present legends remain telling of good values and lost mines.

Boy Edgar Mine. This mine was worked some years ago by the owner, C. H. Staut of Ukiah, and is reported to have been rich in free gold. The ledge was lost and hunted for by prospectors but has never been found. It was supposed to be located somewhere on the trail from Ukiah to Lost Valley. C. H. Staut, the former owner, died several years ago.

Van Allen Mine. This property is situated 6 miles west of Ukiah at an altitude of one thousand feet. There are two claims named "Carrie" and "Fred." The strike of the formation is northwest and southeast and the dip 20° NE. There are five prospect tunnels. The one in which the last work was done is a crosscut tunnel 170 feet long. This tunnel has cut several stringers of quartz in a hard, tough blue glaucophane schist. Only assessment work is being done. Property is owned by William Van Allen of Ukiah.

There were several other prospects mentioned in the Thirteenth Report of the State Mineralogist. These, however, were merely locations and the assessment work lapsed soon after the locations were made, so they are not mentioned here.

MANGANESE.

There is a manganese deposit of considerable magnitude located in Secs. 22, 27, 34 and 35, T. 17 N., R. 12 W., M. D. M. Eight claims were located by W. P. Thomas, Requa, Taylor, and others in 1912. The vein is in quartzose schist and the strike is northwest and southeast and the dip 75° to 80° NE. The width varies from 3 feet to 20 feet. In 1912, one thousand dollars was expended in developing the claims and some work has been done every year on the property. Four hundred to 500 feet of the vein has been stripped and crosscut trenches have been cut for several hundred feet more.

The claims are 3 miles from the railroad and a wagon road passes within a mile and a half of it. The ore is of a high quality as will be seen from the accompanying analyses and no doubt will prove a valuable asset to the county at some future time.

Cleveland Property. It is situated 3 or 4 miles from the Thomas property in T. 17 N., R. 12 W., and on the same lode. The ore is a pyrolusite. No work is being done on the claims.

Manganese Assays From Property of W. P. Thomas.

Assay by John Crawford, chemist, for Noble Electric Steel Company, April 4, 1912:

Metallic manganese	52.24%
Dioxide	82.50%

Assay by Abbott A. Hanks, San Francisco, February 21, 1912:

Metallic manganese	54.07%
Dioxide	85.56%

Assay by Abbott A. Hanks, December 22, 1911:

Metallic manganese	56.23%
Dioxide	88.98%

Assay by Abbott A. Hanks, August 6, 1912:

Metallic manganese	56.67%
Dioxide	89.70%

Assay made by Geo. A. James Company, June 22, 1912:

Metallic manganese	52.1%
Dioxide	82.4%
Dioxide (with water removed)	91.2%

Assay by Geo. A. James Company, 28 Belden place, San Francisco, June 24, 1912:

Metallic manganese	54.9%
Dioxide	86.8%
Dioxide (with water removed)	92. %

MAGNESITE.

There are croppings of magnesite in Mendocino County, but they have not been developed. They occur in serpentine formation like most of the other magnesite deposits of California.

Vassar Magnesite Claims. These claims are located 12 miles north of Cloverdale in the southeastern part of the county and within 1½ miles of the California Northwestern Railroad. These croppings are in serpentine and are owned by James Vassar, who owns 1000 acres of ranch land on which the croppings occur. No development has been done. There is another cropping of magnesite in Mendocino County near the northern boundary of Sonoma County.

MINERAL SPRINGS.

There are several mineral springs in Mendocino County, having waters of medicinal properties, as well as some that are palatable as table waters. Some of the springs have well appointed accommodations for guests with excellent transportation equipment for visitors making use of them during the summer months. Some of these waters compare favorably with the famous waters of European resorts, as will be seen from the comparison of their analyses. The climatic conditions are unsurpassed and the scenery equally as beautiful as at other springs of the world.

Vichy Springs. These famous springs are located 3 miles easterly from Ukiah, in Sec. 15, T. 15 N., R. 12 W., and are reached by railroad from San Francisco to Ukiah, and thence by stage to the springs.

The waters belong to the alkalo-carbonated class, are clear and sparkling and of an agreeable pungent taste. Their chemical composition and action on the human body are almost identical with the noted Ems on the Lahn, and Fachingen of Nassau, Germany, also Vichy of Grand Grille, France.

It will be observed from a chemical analysis made of these waters that they are heavily charged with carbonic acid gas and carbonates, and that they contain some iron and potassium salts.

Analytical Comparison of Vichy Springs.

Solid ingredients in one gallon of 231 inches in grains	California Vichy analyzed by Dr. Anderson. Temperature 93 degrees F.	Grande Grille, France, Vichy, analyzed by Broquet. Temperature 105.8 degrees F.	Fachingen, Nassau, Germany. Analyzed by Frisenius. Temperature not given	Ems on the Lahn, Germany. Analyzed by Fresenius. Temperature 115 degrees F.
Sodium chloride	28.60	32.80	36.48	62.16
Sodium carbonate	195.52	208.00	155.84	84.24
Sodium sulphate	.36	18.32	1.12	trace
Sodium phosphate	----------	6.24	.41	----------
Potassium chloride	.09	----------	----------	----------
Potassium carbonate	trace	16.32	----------	----------
Potassium sulphate	trace	----------	----------	3.03
Magnesium carbonate	19.75	11.04	10.85	6.80
Calcium carbonate	18.14	18.48	16.09	10.00
Ferrous carbonate	.07	.16	.64	.16
Strontium carbonate	----------	.08	trace	trace
Barium carbonate	----------	----------	----------	trace
Lithium carbonate	----------	----------	trace	----------
Borates	trace	----------	----------	----------
Arsenates	----------	.08	----------	----------
Aluminates	trace	----------	trace	trace
Silica	5.92	.40	2.09	2.88
Totals	268.45	311.92	223.52	169.27
Cubic inches of gases:				
Carbonic acid gas	224.75	14.74	263.76	54.24

California Seltzer Springs. These springs are located in the coast range of mountains in southern Mendocino County, twelve miles north of Cloverdale, Sonoma County. There is a hotel on the property. The waters are carbonated and sparkling, and are quite palatable. An analysis by Winslow Anderson, M.D., gives the following:

	Grains per U. S. gallon
Sodium chloride	17.15
Sodium bicarbonate	53.00
Magnesium carbonate	44.60
Calcium carbonate	72.40
Ferrous carbonate	trace
Silica	trace
Organic matter	trace
Total solids	187.15

Temperature, 57°.
Free carbonic acid gas, 18.00 cubic inches.

Orr's Mineral Springs. These springs are situated 15 miles northwest of Ukiah, on the headwaters of Big River, in Sec. 24, T. 16 N., R. 14 W., at an altitude of 1000 feet. They are reached by rail from San Francisco to Ukiah, thence by stage to the springs. The hot sulphur baths are well known. Springs for drinking and bathing purposes occur, varying in temperature from cold to 107° F.

Reported Analysis of Orr's Mineral Water.

	Grains per U. S. gallon
Silica	1.917
Silicate of soda	15.502
Oxide of lime	.425
Carbonate of lime	.367
Sodium carbonate	.175
Sodium chloride	1.909

There are three springs called the "Cold Sulphur," "Hot Sulphur," and "Iron Spring." The "Hot Sulphur" water has a temperature of 106° F.

Duncan Springs. The springs are located 1½ miles southwest from Hopland Station, in Sec. 25, T. 13 N., R. 12 W. Hopland is on the California and Northwestern Railroad and stages connect with trains. There are five cold springs on the property, two of which are soda, and one a sulphur spring. The other two are called the "Borax" and "Duncan" springs, the latter being the principal one. The water from this spring is claimed to be similar to the celebrated Bartlett Springs.

Reported Analysis of Duncan Springs.

	Grains per gallon
Bicarbonate of magnesia	90.11
Chloride of magnesia	1.41
Sulphate of magnesia	1.64
Bicarbonate of lime	15.64
Silica	6.94
Bicarbonate of potash	2.37
Bicarbonate of soda	2.37
Free carbonic acid	36.57
Total	157.05

Garby's Springs. These small alkali springs are situated at the base of the foothills, one mile west of Ukiah.

Lane's Springs. These are located in Redwood Valley near Calpella. The waters have an alkaline but pleasant taste.

OIL.

Some drilling for oil was conducted in the county during the oil excitement in the years 1865, 1866, 1867, but no oil in paying quantities was obtained. The oil was of excellent quality. Experiments were made with the bituminous sandstones to see if oil could be distilled from them in payable quantities. The experiments yielded a fair percentage of oil but the cost of production and freight to the consumer was too high to be a profitable venture.

These bituminous sandstones have been developed, mostly in the neighborhood of Point Arena. The beds in that region are 20 feet thick and yield from 10% to 11% volatile matter. Picked specimens run as high as 15% in volatile matter, but the bituminous sandstones as a whole are not sufficiently impregnated with petroleum to compete with other deposits of the State.

QUARRIES.

There are no quarries operating in the county at the present time. The best quality of road metal being used in Mendocino comes from Petaluma, Sonoma County. The metamorphic rocks of the county are not suitable for road building.

PART IV.

The Counties of

Fresno, Kern, Kings Madera, Mariposa Merced, San Joaquin Stanislaus

By WALTER W. BRADLEY, G. CHESTER BROWN, F. L. LOWELL, R. P. McLAUGHLIN
Field Assistants

INTRODUCTION.

The group of counties presented in the chapters herewith covers the great San Joaquin Valley section of California, from its junction with the Sacramento River to its extreme southern limits (except Tulare County, for which the field work is not yet completed). It extends into the Coast Range Mountains on the west, to the summit of the Sierra Nevada Mountains on the east, and into the desert region for a short distance south and southeast of the Tehachapi where those two mountain systems come together. In this district are found such natural wonders as the Yosemite Valley, the Mariposa and General Grant Park Big Tree Groves, the Kings River Canyon and the Devil's Post Pile. Of mineral and geologic interest, we find the southern end of the great Mother Lode Gold Belt; also the Kern and Fresno County oil fields, the two largest petroleum producing districts in California. This branch has already been covered in a special report. In the valley sections, of course, agriculture is the dominant industry; dairying also is prominent. Both in the valley and in the mountainous sections stock raising is an important industry.

The valley is traversed north and south by two transcontinental railroad systems, and tapped at its northern end by a third. Several oil pipe lines carry the product of the wells to refineries and distributing points at tidewater.

This report represents the results of about three months' field work by the several authors, more or less simultaneously in their various areas, during the late summer of 1914. We have here endeavored to record all of the mineral resources and properties which have been the subject of commercial exploitation, as well as to mention some additional occurrences, as yet undeveloped.

Acknowledgment is here made of assistance rendered by the various owners and operatives of properties, both during the field work and in the subsequent preparation of this report.

FRESNO COUNTY.

By WALTER W. BRADLEY, Field Assistant.

Field Work in August and September, 1914.

Fresno County was created April 19, 1856, and up to 1893 included the territory now in Madera County. In the early days, Millerton, now abandoned, near Friant, was the county seat. It is still among the larger counties of the State, having an area of 5977 square miles, or nearly three times that of the State of Delaware. Madera and Merced counties are on its north, Mono and Inyo on the east, Tulare and Kings on the south, with San Benito, Monterey, and San Luis Obispo adjoining it on the west. The San Joaquin River separates Fresno from the first named county, and the eastern boundary runs along the summit of the Sierra Nevada Mountains. Along this line are numerous peaks

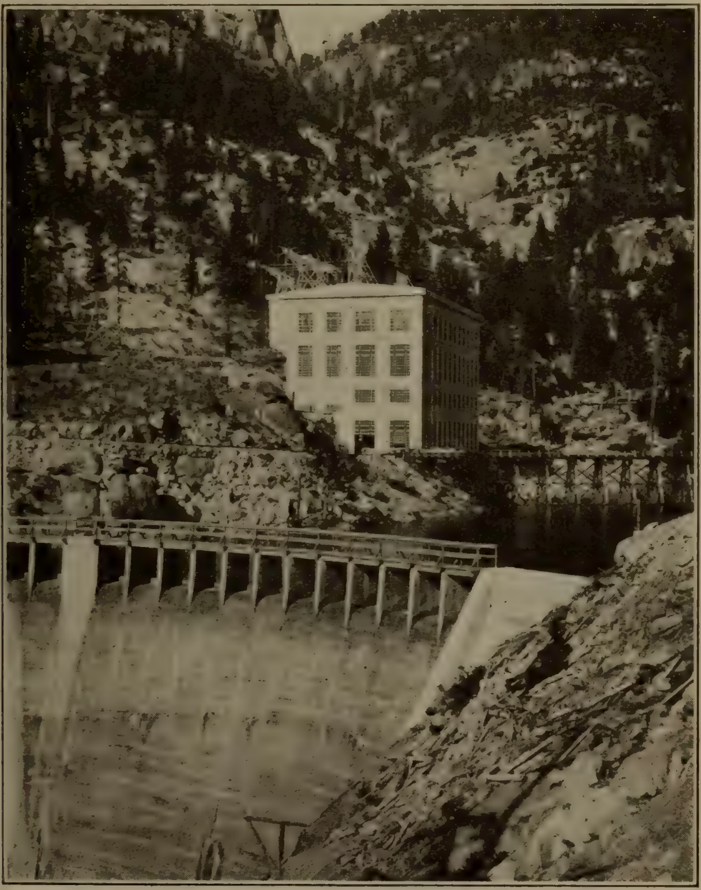


Photo No. 68. No. 1 power plant of Pacific Light and Power Company, at Cascada (Big Creek Post Office), Fresno County. Dam retains water for No. 2 plant, five miles below.

exceeding 13,000 feet in elevation above sea-level, among which may be mentioned Mt. Abbott, 13,736 feet; Bear Creek Spine, 13,705 feet; Mt. Humphreys, 13,972 feet; Mt. Darwin, 13,841 feet; Mt. Powell, 13,361 feet; Agassiz Needle, 13,882 feet; Mt. Winchell, 13,749 feet; North Palisade, 14,254 feet; Middle Palisade, 14,049 feet; Mt. Pinchot, 13,471 feet, and University Peak, 13,588 feet. At the Kearsarge Pass the trail to Independence in Inyo County crosses the divide at an elevation of 11,823 feet. The western boundary of the county follows along inside of the first line of ridges of the Diablo Range, just back from the edge of the San Joaquin Valley.

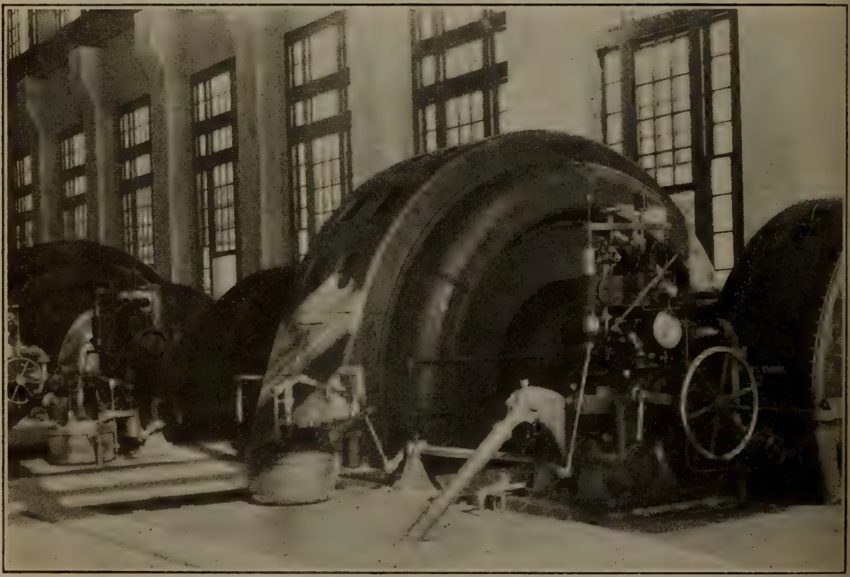


Photo No. 69. Generators and water wheels, No. 1 power plant, Pacific Light and Power Company, Cascada, Fresno County.

The main drainage systems of Fresno County are those of the San Joaquin and Kings rivers and their branches. Much has been written and much more could be written of the wonder and rugged grandeur of the Sierran streams, canyons, cliffs, peaks and snowfields, delightful camping spots and unexcelled trout fishing—but they are here merely mentioned in passing. The streams of the western side of the county are only seasonal creeks, being dry in summer and lost sight of in the valley flats, except in times of exceptional winter rains.

In the valley proper, with water drawn from the San Joaquin and Kings River systems (principally the latter), over 400,000 acres of land are under irrigation. The various systems serving the county comprise some 450 miles of main ditches, with capacity exceeding 6000 cubic feet per second; also about 5000 miles of distributing canals. Water is sold at the rate of 62½ and 75 cents an acre yearly. The census of 1910 showed 888 pumping plants in the county, with a capacity of 515,380 gallons per minute, and the cost varies from $1.50 to $4 per acre. The number of pumping plants has increased rapidly since 1910. The Hume-Bennett Lumber Company, with a 75-mile flume, utilizing water from the Kings River, transports lumber from its mill at Hume to the railroads at Sanger. Its production is approximately 35,000,000 feet per year. The Fresno Flume and Lumber Company, with mills of an equal capacity at Shaver, ship via a 45-mile flume to Clovis. The water discharged from these flumes at their terminals is used for irrigation in the valley.

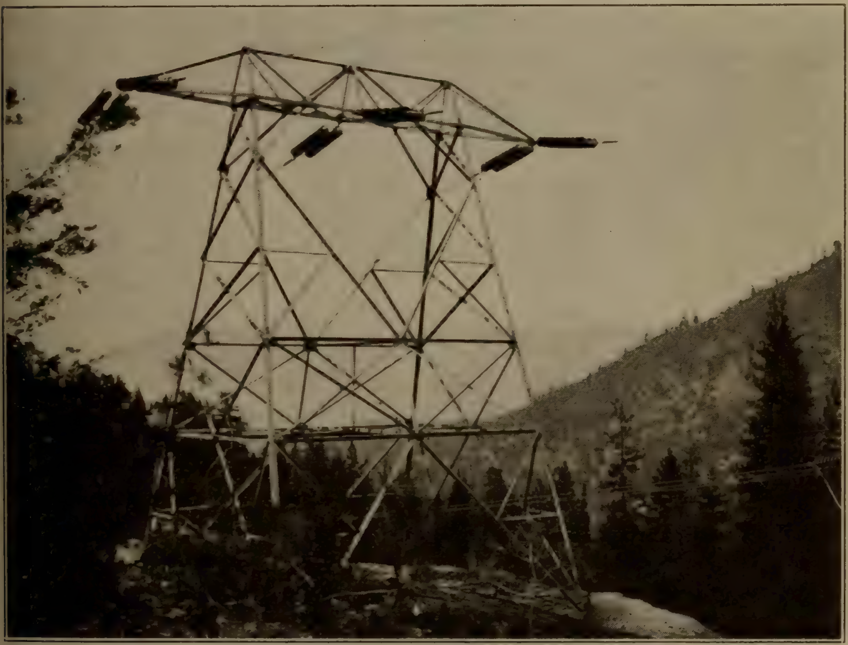


Photo No. 73. Transmission tower, 150,000 volts. Pacific Light and Power Company, near Cascada, Fresno County.

As to power for mining, industrial and agricultural purposes, this territory is well provided. Besides the electric power lines, many pumps for irrigating are driven by distillate engines and some by crude oil, the proximity of the oil fields at Coalinga being an advantage. The San Joaquin Light and Power Corporation distributes 40,000 horsepower in Fresno County, provided by two hydroelectric plants in Madera County and a steam plant in Fresno. Its main transmission is at 60,000 volts to its substations. In addition this company has power plants in Kern County. The Pacific Light and Power Company, though it does not distribute any power in Fresno County, has two hydroelectric plants on Big Creek, a branch of the San Joaquin River. These two plants are each ultimately to have 60,000-kilowatts capacity, one half of which being at present installed and in operation. No. 1 plant (see photos Nos. 68 and 69) at Cascada (Big Creek post office), operates with a static head of 2104 feet (950 pounds per square inch, gauge pressure at the water wheels); while No. 2 plant, 5 miles below, has a 1900-foot head. The power is taken through to Los Angeles by a 150,000-volt transmission with aluminum cables on steel towers (see photo No. 73).

The county is traversed by two transcontinental railroad systems—the Southern Pacific and the Santa Fe. There are six oil pipe lines transporting crude oil from and through Fresno County. The Associated Oil Company has two 8-inch lines to Port Costa and a 6-inch line to Monterey. The Standard Oil Company has two 8-inch lines to Point Richmond, and the Producers Transportation Company has an 8-inch line to Port Harford. The Shell Oil Company is building an 8-inch line to Martinez.

The farm, fruit and lumber products of Fresno County at the present time total about $30,000,000 in value annually. Its total mineral product for 1913 was valued at $8,438,810. The total recorded mineral output of the county to the end of 1913 (see table opposite) is $67,669,637, from which we have deducted $1,375,000 gold and silver yielded from 1880–1892 by the territory then in Fresno, but now a part of Madera County. This leaves a net value of $66,294,637. The products in the order of their value to date are: petroleum, stone industry, copper, brick, gold, magnesite, mineral water and silver, with asphaltum, chrome, clay, coal, gypsum, gems, natural gas, and quicksilver, making up the list, combined under "miscellaneous and unapportioned." In addition, occurrences are known of asbestos, marble, pumice, limestone and tungsten, but they are as yet undeveloped.

ABRASIVES (see Volcanic Ash).

ASBESTOS.

J. E. Ellwood of Sanger, reports that he has a deposit of amphibole asbestos 30 miles east of Sanger. It is undeveloped.

Hogue and Phillips Claim. R. L. Hogue, Fresno, and Mr. Phillips, Letcher, owners. Some small bunches of asbestos have been taken out from this prospect in T. 13 S., R. 23 E., 12 miles north of Sanger.

Bibl.: Bull. No. 38, p. 262.

ASPHALT.

There is no natural asphalt occurring in Fresno County, but the manufactured article is obtained from the residue in the refining of crude petroleum. In the earlier statistical reports its value was given,

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FRESNO COUNTY—Table of Mineral Production.

Year	Gold. Value	Silver. Value	Copper		Petroleum		Brick		Stone industry. Value	Mineral water		Magnesite		Miscellaneous and unapportioned	
			Pounds	Value	Barrels	Value	Thousands	Value		Gallons	Value	Tons	Value	Kind	Value
1880	$143,433														
1881	90,000													Unapportioned, 1900-1909, inclusive	$268,534
1882	80,000														
1883	100,000														
1884	80,000														
1885	74,500	$2,456													
1886	151,186	2,701													
1887	205,242	274													
1888	200,000	2,800													
1889	185,988	4,629													
1890	49,951	1,816													
1891	82,607	10,396													
1892	112,981	6													
1893	7,118														
1894	8,202													216 tons coal 500 tons gypsum	700 4,000
1895	47,249													600 tons gypsum	4,800
1896	28,235	100			14,119	$56,750				1,200	$400			50 tons gypsum	400
1897	43,144				70,140	70,840				1,886	350				
1898	27,557				154,000	154,000	2,500	$18,000		2,000	900			100 tons gypsum	600
1899	18,142				439,372	439,372	5,500	38,500		2,000	900			16 tons asphalt	320
1900	22,346	479			547,960	547,960	4,250	35,062		5,000	4,000				
1901	21,462		1,159,672	$182,648	525,433	236,444	5,000	35,000		5,142	5,142				
1902	54,427		3,000,000	345,000	571,233	199,931	6,000	45,000		5,000	4,500				
1903	21,538	111			2,214,160	730,673	8,000	68,000	$11,038	7,200	7,200			839 tons asphalt	10,068
1904	7,809	4	2,500	319	5,114,958	1,520,847	4,800	32,400		4,800	2,400	38	$120	579 tons asphalt	6,948
1905	40,037	9,187	1,440,000	224,640	8,890,000	2,400,300	9,000	60,000							
1906	8,493	83	440,000	88,000	8,402,000	1,974,470	8,000	64,000							
1907	2,401	26	250,000	50,000	9,050,300	3,620,120	9,230	57,350	10,500						
1908	1,054	11			10,725,389	5,898,964	13,220	106,960	16,900					500 tons asphalt 9,000 tons clay	5,500 26,000
1909	17,539	8,503	876,837	111,341	15,406,619	9,243,971	7,950	49,375	28,400			850	8,500	400 tons asphalt	4,400
1910	3.373	2,980	486,725	61,999	18,651,470	9,277,241	9,533	76,267	58,089			1,400	22,400	200 tons asphalt Gems	2,600 750
1911	17,441	81			19,499,611	9,344,085	4,500	28,500	318,911			220	2,195	Gems	250
1912	6,094	23			19,510,932	8,487,255	5,000	40,000	307,158			2,000	20,000	50 tons chrome Gems 336 flasks quicksilver Gas	950 700 14,125 21,380
1913	2,846	15			18,956,965	7,927,736	5,500	44,000	416,437			1,135	9,080	375 flasks quicksilver Gas, 236,100 M cubic feet	15,086 23,610
Totals	*$1,962,395 1,350,000 $612,395	†$46,681 25,000 $21,681	7,655,734	$1,063,947	138,744,661	$62,130,959	107,983	$798,414	$1,167,433	34,228	$25,792	5,643	$62,295	Total miscellaneous	$411,721

†Of this about $25,000 came (1880-1892) from that part now in Madera County.

*Of this about $1,350,000 came (1880-1892) from that part now in Madera County.

Totals.

Gold	$612,395
Silver	21,681
Copper	1,063,947
Petroleum	62,130,959
Brick	798,414
Stone industry	1,167,433
Mineral water	25,792
Magnesite	62,295
Miscellaneous and unapportioned	411,721
Total to end of 1913	$66,294,637

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but as it is included in the value of the crude oil from which it is derived, refined asphalt is not now entered independently; to do so would result in a duplication. The California Fresno Oil Company, A. Buttner, Fresno, manager, is the only refinery producing asphalt in this county. Its output is small.

BRICK AND CLAY.

Boger Gravel Pit (see under Stone Industry).

Craycroft-Herrold Brick Company. C. J. Craycroft, president; F. J. Craycroft, secretary; office, 407 Griffiths-McKenzie Building, Fresno.

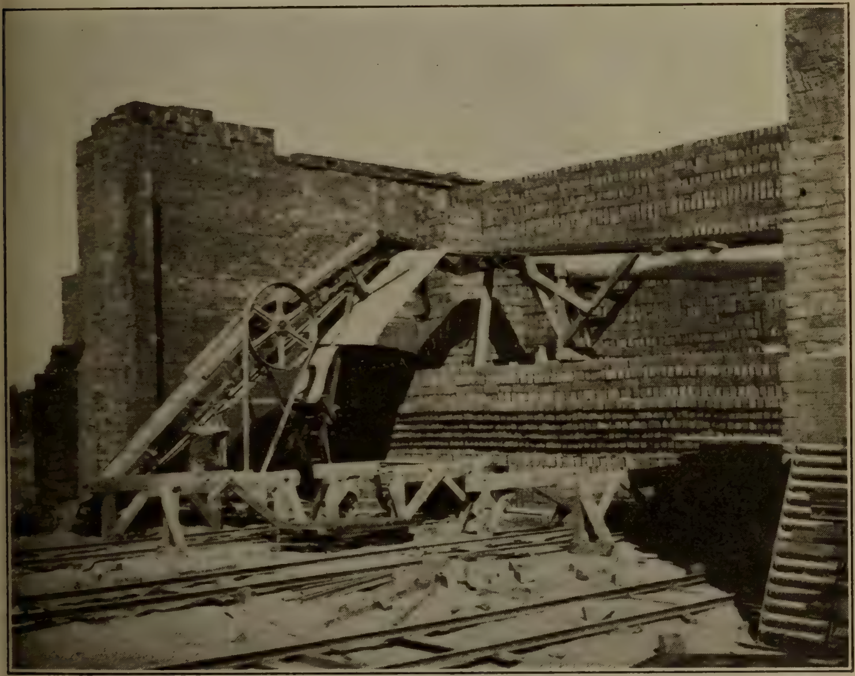

Photo No. 27. Brick elevator and conveyor, (electric driven), for charging kiln. Craycroft-Herrold Brick Company, Fresno County.

The plant of the company is at Crayold siding on the Kerman branch of the Southern Pacific Railroad, 3 miles west of Fresno. Under the name of C. J. Craycroft & Son Brick Company, a plant was formerly operated about 1 mile south of town. The present plant, which started in 1911, has a daily capacity of 50,000, and electric power is used. The clay is obtained from a superficial, flat valley deposit about 5 feet thick. It is loosened by pick and shovel and trammed to the mill where it is ground and passed through a stiff-mud machine.

The rectangular stream of stiff mud is cut up by a wire cutting brick machine (see photo No. 25), from which it passes onto a belt conveyer.

As the conveyer moves slightly faster than the mud stream, the bricks are separated so that they can be easily taken up by hand and transferred to cars and then run to the drying sheds. They are burned in field kilne having permanent side walls, and oil-fired (see photo No. 28). An electric driven elevator and conveyor is used in charging the kilns (see photo No. 27). There are 7 field kilns with a capacity of 700,000 each, and one circular kiln for re-pressed brick. From seven to ten days are required to burn a kiln. During seven months twenty-five to forty men are employed, according to the market demands, and five to ten men the balance of the year. The present outlook of the business is quiet.

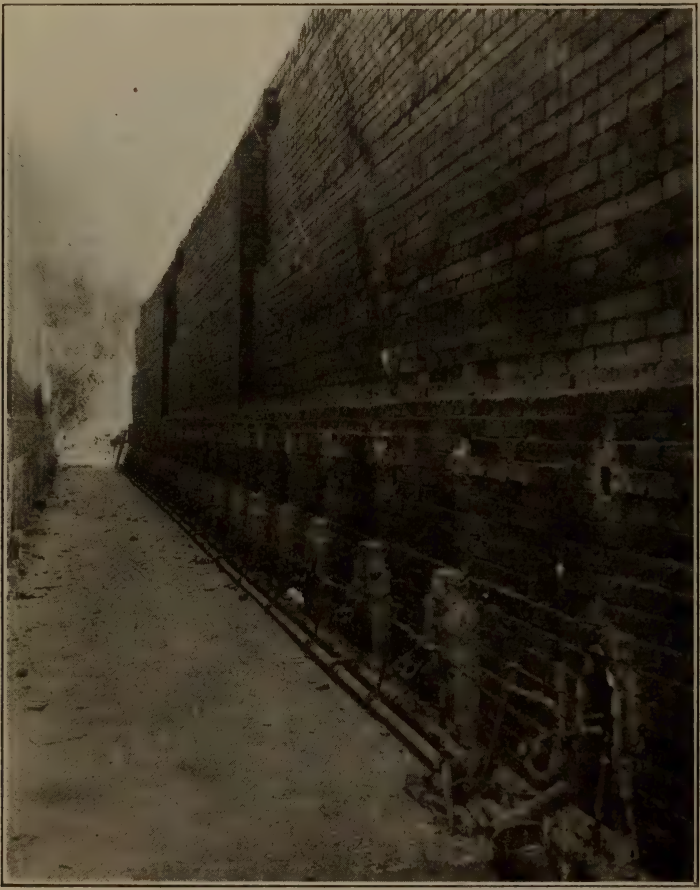

Photo No. 28. Crude oil burners for brick kiln, Craycroft-Herrold Brick Company, Fresno County.

Bibl.: Bull. No. 38, p. 242.

Fresno Brick and Tile Company. F. Dean Prescott, president; E. M. Prescott, vice president and manager; James A. Douglas, superintendent. Office, H and Mono streets, Fresno. The plant is at Mars siding on the Southern Pacific, about 1 mile southeast of the city limits. This company formerly operated north of town. The clay is loaded by hand to side-tipping cars and drawn by horses to the storage bin. After coming from the brick machine (see photo No. 25), most of the product is sun-dried, but some by steam. There are six field kilns, three of which have permanent side walls, and are oil-fired (see photo No. 28). Their capacity is 600,000 per kiln and seven days are required for burning. An average of thirty-five men are employed.

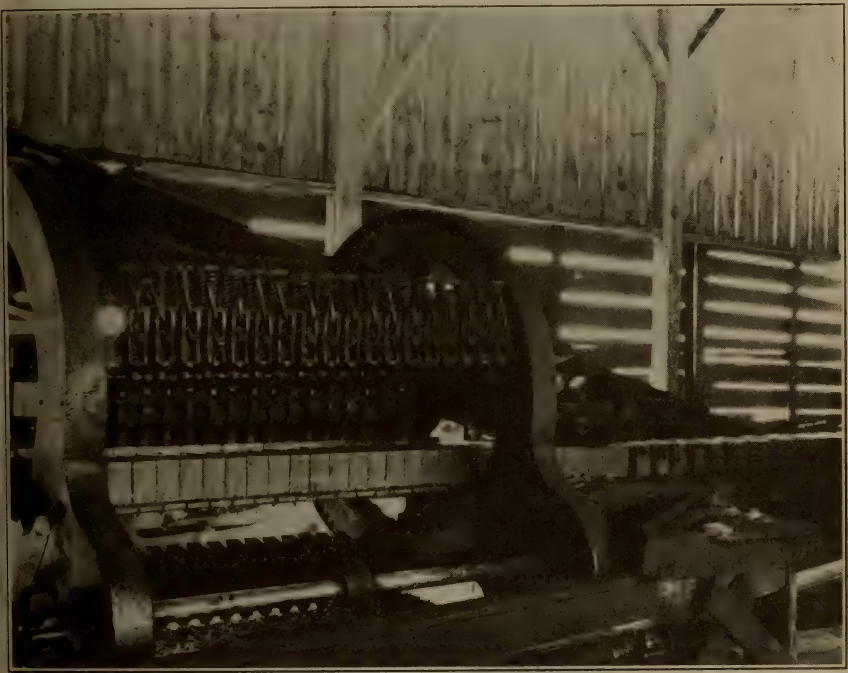

Photo No. 25. Wire brick cutting machine, Fresno Brick and Tile Company, Fresno.

Bibl.: Bull. No. 38, p. 243.

CHROMITE.

Chromite occurs in a serpentine belt near Sentinel in T. 11 S., R. 23 E., and running southeasterly into T. 12 S., R. 24 E. The Copper King Mines Company, when operating its smelter, used chromite from his vicinity.

Frank Alexander, of San Francisco, has some claims in the northwestern part of Watt Valley, from which chromite has been shipped, ut none recently.

Victor Roberts, of Coalinga, has a deposit of chromite in Sec. 9, T. 22 S., R. 14 E., southwest of Coalinga. There is said to be a large deposit of good quality near the center of T. 18 S., R. 13 E., northwest of Coalinga.

Bibl.: R. X, p. 189; XIII, p. 49; Bull. No. 38, p. 268; Min. Res. West of Rocky Mountains, 1868, p. 224.

COAL.

In the southwest corner of Fresno County are two localities where coal occurs, and which were producing in the early nineties. In the Coalinga field, the San Joaquin Valley Company, west of Coalinga, was the principal producer, and in 1894 was shipping at the rate of 300 tons of coal per month, principally to Fresno. The other locality, known as the Priest Valley field, is near the junction of Fresno with San Benito and Monterey counties, and includes the Stone Canyon mine in the last named. This coal is semi-bituminous, while that of the Coalinga field is a lignite, as is most of the California coal.

With the rise of the petroleum industry our coal, because of its poor quality and its cost of mining, has been relegated to the background; in fact, its production has practically ceased entirely. No work has been done on the coal beds of Fresno County since 1896.

Bibl.: R. VII, pp. 148, 172; IX, p. 323; X, p. 186; XI, p. 217; XII, pp. 50–54; XIII, p. 53; Bull. 67, pp. 194, 196; U. S. G. S., Bull. 398, p. 49.

COPPER.

The principal copper district of Fresno County is in the southern extension of the "Foothill Copper Belt," of the western edge of the Sierra Nevada Mountains. The only property here which has mad any noteworthy yield of copper so far is the Copper King mine described below. Because of the success of this one, a number of claim and prospects have been located in its neighborhood, but none of ther have amounted to anything as yet, and they are all now idle. This district in 1865 made shipments amounting to 1440 tons of copper ore.

Farther back and near the summit of the main range of the Sierra the mineralized belt, which is more prominently known at The Minaret in Madera County, passes through Fresno County. In this belt coppe ore has been found on Mt. Godard at an elevation of 12,000 feet abov sea level; but owing to its inaccessibility it is undeveloped. Othe occurrences are noted below.

Bibl.: R. VIII, p. 209; X, p. 194; XI, p. 217; XII, p. 66; XIII, pp. 58, 59; Bull. 50, pp. 277–289; Bull. pp. 17, 40; Min. Res West of Rocky Mts., 1868, p. 174.

Ackers Claim (see Expositor).

Black Jack Claim. V. F. Moore, Kingriver, R. F. D., owner. It is in Sec. 14, T. 12 S., R. 24 E., west of Trimmer, and located in 1910. It is stated that the ore zone is 150 feet wide, carrying 2½ per cent copper, with occasional high grade bunches. There is a small tonnage of high grade ore on the dump. Assessments only are maintained. There are two shafts, 125 and 20 feet, respectively, the former having two crosscuts and an 18-foot drift. The vein strikes northwest and dips 75° NE. The hanging-wall is schist and the footwall granite.

Copper King Mine (see Hart Copper Company).

Expositor and Summit Claims. Henry Ackers, Sanger, owner. About Sec. 10, T. 12 S., R. 24 E., 10 miles south of east from Letcher. There are two adits on the Expositor, 100 feet each, and a 60-foot shaft, the latter being filled with water when visited. On the Summit there is an adit of 140 feet. Both oxidized and sulphide ores occur. Assessments only.

Bibl.: R. XII, p. 66; XIII, p. 58.

Fresno Copper Mines (one time called Heiskell). Fresno Copper Company, Ltd., owner; C. C. Leavitt, manager, 585 Jean street, Oakland. This group of five claims is in Sec. 10, T. 12 S., R. 21 E., 4 miles east of El Prado on the Southern Pacific Railroad. There is an extensive surface equipment, including a smelter with two furnaces of 200 tons capacity each. The smelter has never been operated, as it is stated that about the time it was completed the ore was found to fall far short of its expected value. Steam furnished the power for the hoist and air compressor, while the pump, lighting plant, sawmill and shops were operated by electricity from the San Joaquin Light and Power Company. A more detailed description of the property is given in Bulletin No. 50. Idle since 1908.

Bibl.: Bull. No. 50, pp. 279–281.

Hart Copper Company (formerly Copper King, Ltd.). Truman Hart, president; A. W. Anderson, secretary; office, 716 Griffiths-McKenzie Building, Fresno. The mine, which is patented, is in Sec. , T. 12 S., R. 23 E., east of Letcher, and the smelter is at Seal Bluff Landing on Suisun Bay, Contra Costa County. Under the Copper King Company, operation of both the mine and smelter was a failure, but he present owners, who bought the property at a court sale, have hipped ore to a custom smelter and made a profit above the purchase price. No output has been made since early in 1908, but the roads nd equipment are kept in repair and a watchman is employed. They eport a fair tonnage of ore blocked out and that it is intended to resume shipments when the market and transportation facilities improve. At present it is a 17-mile haul to the railroad. See Bulletin No. 50 for a more detailed description.

Bibl.: R. X, p. 194; XII, p. 66; XIII, p. 59; Bull. 50, pp. 282–286.

Kenawyer Group. Mrs. V. Kenawyer, owner, Kenawyer via Hume. This group of eight claims is in Sec. 11, T. 13 S., R. 31 E., near the junction of Copper Creek with the South Fork of Kings River; elevation 6000 feet. Assessment work is maintained.

Bibl.: R. XI, p. 217; XII, p. 66; Bull. No. 50, p. 289.

Painter Mine. Imperial Copper Mining Company, owner. In Sec. 33, T. 11 S., R. 21 E., southeast of Friant. Patented. Several hundred tons of copper ore have been shipped. Idle for years.

Bibl.: Bull. No. 50, p. 278.

Pleasant View (see Apache under Gold).

Uncle Sam Group. W. C. Luce et al., Trimmer, owners. This group of eight unpatented claims, located in 1906, is in Secs. 2 and 3, T. 12 S., R. 29 E., on Crown Creek, opposite Tehipite Dome, and 59 miles east of Piedra on the Santa Fe Railroad. It is in an almost inaccessible position above Tehipite Valley on the Middle Fork of Kings River. Elevation 5500 feet (U. S. G. S.). Development consists of a 30-foot shaft with 8 feet of drift, an adit of 50 feet, and some small surface cuts. The vein is from a few inches to two feet in width and carries azurite, malachite, bornite and magnetite. A large proportion of the mineral claimed by the owner to be bornite proved on examination to be magnetite. The country rock is schist and slate, but near the contact with the granite composing Tehipite Dome. Three men were at work this summer (August, 1914). Abundant hydroelectric power could be developed.*

No doubt this high Sierran mineral belt will be developed some day, but in its present state of lacking transportation, the writer can not see how anything but a high grade free gold proposition could be made to pay, much less a copper mine.

DIATOMACEOUS EARTH (see Infusorial Earth).

FELDSPAR.

J. K. Apperson and C. C. Overstreet, of Trimmer, have three claims located on a deposit of feldspar in Sec. 34, T. 11 S., R. 25 E., 5 miles northeast of Trimmer and 2 miles southwest of the Contact mine. Beryl and topaz are stated to be associated with the feldspar.

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*September, 1915.—Luce reports opening up in the shaft, this summer, a body of high grade ore, and that it is the intention to ship two or three carloads to the smelter before snow closes the trail for the winter. It will be packed, via Dinkey Creek, 35 miles to a spur of the San Joaquin and Eastern Railroad near Shaver. Specimens of this ore shown us, carry mainly bornite and magnetite with some visible free gold.

FULLER'S EARTH.

A number of claims have been located in the Kettleman Hills section, southeast of Coalinga, on deposits reported to be fuller's earth. As far as we could learn, no practical tests of its value as a filtering and decolorizing medium have been made.

The *Walker-Mundy* claims, located by I. H. Patterson, A. D. Ewing et al., of Fresno, are in Sec. 32, T. 21 S., R. 17 E. Material from these claims, on examination in the laboratory of the State Mining Bureau, proved to be a volcanic ash, not particularly fine grained.

At Wahtoke siding on the Piedra branch of the Santa Fe, 5 miles north of Reedley, there is a stratum of white material 5 to 10 feet thick, said to be fuller's earth. It is exposed in a cut, where earth for railroad fills is being taken out with a steam shovel.

GEM MATERIALS.

Beryl and Topaz (see note under Feldspar).

Californite. "Jade mine." Nat Parker and Prothero Bros., Visalia, owners. On the south side of Watt Valley, in Sec. 5, T. 12 S., R. 24 E., located in 1909. The product has been marketed through the Southwest Turquoise Company, 318 West Fourth street, Los Angeles. There is a series of small adjacent veins totaling about 3 feet wide, in serpentine, exposed in several surface cuts and a shallow shaft. So far as developed the material is more or less fractured. The vein strikes southeast and dips northeast, nearly vertical. At present only assessment work is done. There is a white garnet associated with this californite. Because of occasional bright green spots in the mineral, it was thought by some locators to carry nickel, but an analysis made in the laboratory of the State Mining Bureau shows no nickel present.

> Bibl.: Bull. 37, p. 94; Bull. 67, p. 125; U. S. G. S., Bull. 262, pp. 72–74; Min. Res. 1902, p. 747; 1911, Pt. 11, p. 1044.

Hyalite has been found at one or two points in the Sierras in Fresno but not exploited.

Tourmaline. Red and green tourmalines are found in quartz on the White Divide, south of Mt. Godard, at an elevation of about 12,000 feet. A few stones from here have been cut for gems. On Spanish Peak, in Sec. 1, T. 12 S., R. 28 E., at an elevation of 9700 feet there s a ledge of white quartz in schist, carrying brown garnets and green tourmaline. The material on account of being somewhat shattered and translucent, is not suitable for gems except occasional small crystals of the tourmaline. A mining location had been at one time filed on this ledge and a small hole blasted out.

Vesuvianite (see Californite).

GOLD.

In the early days and up to as late as 1903 more or less placer mining as well as quartz, was carried on in many of the gulches and canyons in the foothill region of the Sierras in Fresno County. Among these may be mentioned particularly Temperance Flat, Sampson's Flat, Big Dry Creek district, and along the San Joaquin River around old Fort Miller above Friant (formerly Pollasky). Most of the placers, being only superficial, have been worked out. Some of the quartz properties have been abandoned, and others consolidated, so that many of the names listed in the older reports do not now appear.

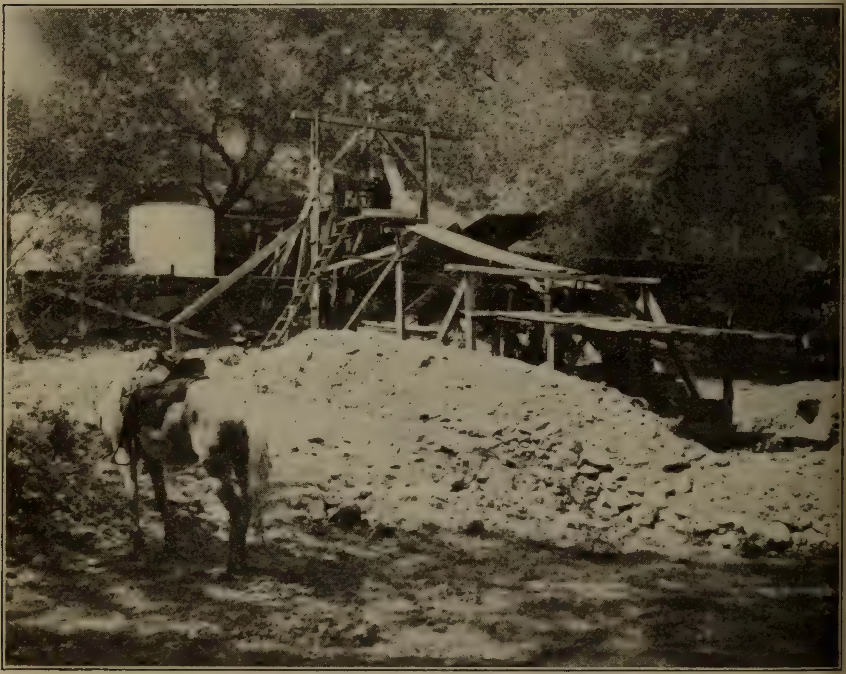


Photo No. 34. Two-stamp mill at Apache Mine, Trimmer, Fresno County.

Alice, Babby and Cloud Claims. William Terrill, Trimmer, owner. On Eagle Peak north of Trimmer. Assessments only.

Apache (formerly Pleasant View). Wm. Terrill, Trimmer, Dr. Powers et al., of Sanger, owners. There are two unpatented claims, on the north bank of the Kings River, in Sec. 20, T. 12 S., R. 24 E., 1 mile south of Trimmer Springs. The ore occurs as an impregnation in mica schist at a contact with serpentine. Granite is near-by on the west of the schist. The ore is principally base (pyrrhotite, chalcopyrite and pyrite), carrying some values in copper besides a little free gold. A working test at the Selby smelter is stated to have yielded

$22.50 per ton, concentrates 10 per cent, assaying $115 per ton. A 700-foot adit had crosscut the ore zone (August 1, 1914) showing a width of 10 feet at a depth of 440 feet. Other developments consist of shallow surface workings. Equipment includes a 2-stamp triple-discharge mill with a 2½-foot by 10-foot plate, and a 6-foot Frue vanner, driven by a 9 horsepower gasoline engine (see photo No. 34). Water is pumped from the Kings River to tanks above the mill. Concentrates will be shipped. Four men at work.

Arkansas, Black Bull and Arrastra Claims. Wm. Terrill et al., Trimmer, owners. On Sycamore Creek, in Sec. 5, T. 12 S., R. 25 E. There are two tunnels aggregating 500 feet. Assessments only.

Bantam Prospect. J. R. Fike, Trimmer, owner. On agricultural patented land, in Sec. 24, T. 12 S., R. 24 E. There is an incline shaft down 65 feet and a drift south 40 feet with a winze 50 feet. The quartz vein between granite walls is from a few inches to 2 feet wide, carrying pyrite, chalcopyrite and marcasite. Values are bunchy, said to average $4 to $5.

Benson (see Little May).

Big Sampson (see Delilah Mining Company).

Black Jack (see Delilah Mining Company).

Boger Gravel (see under Stone Industry).

Brushy Ridge Mining Company. M. Finnegan et al., Dunlap, owners. This group of eight claims is between the M. and M. and the Dixie Queen, about a mile from Dunlap. Elevation 1800 feet (bar.). The present company has had the property since January, 1907. The ld shaft, down 30 feet, is said to have yielded a pocket of free gold re which was treated in an arrastra. There are two short adits. The new incline shaft is down 206 feet, with a crosscut of 50 feet at the 00-foot level, showing the vein 12 feet wide, assaying $1 per ton. Drifting has not yet reached the ore shoot. Country rock is schist. Equipment includes a geared hoist with a 9 horsepower gasoline engine, -inch blower and a "bulldozer" pump.

Richard Burton and Joe Kesterman are working a placer claim on aurel Creek in the NW. ¼, Sec. 11, T. 10 S., R. 26 E., 4 miles northast of the Dinkey Creek Ranger Station.

Cloudburst Mining Co. (quartz), on Home Camp Creek near Casada (Big Creek P. O.), is maintaining assessments only. J. St. Claire, reston, Idaho, P. Donovan et al., owners.

Contact Mining and Milling Company (one time known as McDuff nd McMurty, also Ira Hawk). J. K. Apperson, president; C. C.

Overstreet, secretary. Post office, Trimmer. There are three unpatented claims on unsurveyed land, about Sec. 23, T. 11 S., R. 25 E., 9 miles by trail from Trimmer, and 22 miles northeast of Piedra. Elevation 2750 feet (bar.) at the mill. The mine was first opened up in 1890 and worked with an arrastra. The present owners have worked it since 1894, incorporating in 1914. The ore occurs in a flat-lying vein

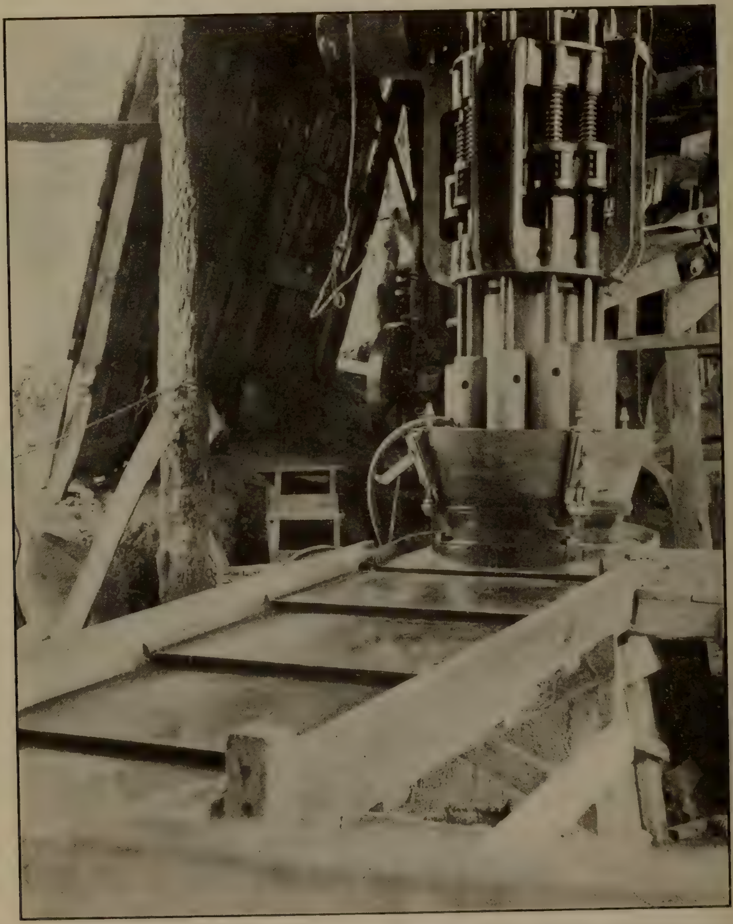


Photo No. 36. Straub patent mill (ten 175-pound stamps) at Contact Mine, Fresno County.

in granite (somewhat decomposed) and carries free gold, also galen and pyrite; average value stated to be $21.25 per ton, including a litt silver. The sulphide ore occurs principally on the west and south, t oxidized ore being to the north and east and carrying the gold mostl in the ochre along the footwall. The pay shoot varies from 4 inch to 2 feet in width. Being a flat deposit all underground work is the vein, including a 110-foot adit and two 60-foot drifts. The grou between the latter two will be stoped out, allowing it to cave behind the work. A depth of 50 feet below the surface is reached. The ore is sledded to the mill about ½ mile.

A Straub patent stamp mill is used (see photo No. 36). This has ten 175-pound stamps, operating in a circular mortar, at 115 drops per minute, 5½-inch drop, with a 40-mesh, diagonal slot screen, and amalgamated plates. It is driven by a 6 h.p. distillate engine. The capacity is given at four tons per twenty-four hours. Five men were employed (July, 1914). There is another vein ¼ mile to the south, 3 feet wide, strike east, dip 45° S., said to assay $11.60 gold and 10 cents silver per ton. There is a tunnel in 90 feet. A cross vein carrying no values runs north and south between the two.

Davis Flat Mine (one time called Little Monitor). Davis Flat Minng Company, owner. T. Elliott, president. Office, Selma. It is in Sec. 1, T. 13 S., R. 26 E., on Sampson Creek about 10 miles northast of Dunlap. The ore is free milling quartz from a series of gash eins. Development work consists of a 75-foot adit, with 60-foot winze, pen cuts and some small stopes and short drifts. Between 400 and 00 tons of ore have been milled, mostly from the open cuts, said to ave yielded $12 per ton. There is a 5-stamp mill with 1250-pound tamps, but the earlier milling was done with an arrastra. Worked ntermittently; idle since 1912 except for assessments.

Bibl.: R. XII, p. 129; XIII, p. 168.

Delilah Mining Company (includes the Big Sampson, Black Jack, ilkie, and Hercules). W. J. Kyle, president; Earl Covel, secretary. ome office, Coalinga. This group of eight claims is in the NE. ¼, ec. 14, T. 13 S., R. 26 E., 8 miles north of Dunlap, elevation 4700 feet bar.). There is a good road from Dunlap to within 1½ miles. It within the boundaries of the Sequoia National Forest. The timber nsists of oak, yellow and sugar pine, and water is obtained from rings. The principal vein as seen on the surface appears to be the contact between an altered pyroxenite and a schist. Under e microscope the pyroxenite shows considerable secondary pyrite pregnating the phenocrysts as an alteration product. There are veral shallow surface cuts, a tunnel in 700 feet and two shafts, and 50 feet, the latter with a 30-foot drift. Some years ago the rmer owners had a cannon ball mill, also a Huntington. There is a x 10″ x 12″ Sullivan compressor, steam driven; and a Leynergersoll water drill is being used. Wood costs $2 per cord, and one rd per day (one shift) is consumed. Five men were at work (August, 14). The tunnel is being driven to crosscut the vein.

Bibl.: R. VIII, p. 207; XII, pp. 127, 128; XIII, pp. 165, 166, 167, 171.

Dixie Queen Mining Company. John Whitt et al., Visalia, owners. This ground is northwest of the Brushy Ridge group, in Sec. 4, T. 14 S., R. 26 E., near Dunlap. There is no vein but the "ore" is an impregnated schist. Reduction equipment consists of a Dodge crusher, and a California roller mill (Chilian), driven by a 25 h.p. Fairbanks-Morse crude oil engine. There is also a 10″ x 12″ air compressor. Only a limited amount of development work has been done. Idle since May, 1914.

Dodge Placer. John Dodge, owner. This placer mine at Kaiser Creek Diggings, in Sec. 4, T. 7 S., R. 25 E., 12 miles due north of Cascada (Big Creek post office), has been worked in a small way by the owner for several years past. Elevation 5500 feet. (U. S. G. S.)

Eastwood Prospect, on the J. S. Eastwood ranch, in Sec. 30, T. 12 S. R. 25 E., south of Trimmer. J. S. and J. C. Riffe, of Kingriver own an undivided half interest in the mineral ground. There ar three shafts, 93, 45, and 37 feet, respectively. The first one show the vein 5 feet wide, strike northwest, dip 30° NE. and steeper wit depth. The footwall is granite and the hanging-wall schist. Th 37-foot shaft shows a 33-inch vein of quartz. No ore has been mille as yet. Assays are stated to show $31.40 gold with a little silver an an occasional trace of copper.

Eliza Jane Mine. Owners, Clark-McClurge Company, 716 Griffit McKenzie Building, Fresno; A. W. Anderson, secretary. R. W. Wa son et al., Fresno, care of San Joaquin Light and Power Compan have a bond on the property. It is in the Hughes Creek District i Sec. 29, T. 12 S., R. 24 E., 4 miles north of Piedra, elevation 115 feet (bar.) at tunnel. It was first worked about 1889 by V. Moor The present owners have had it since 1904, having produced abo $100,000, working at intervals. The ore body is a fissure vein in a ha schist, the value being mostly in free gold with some galena and pyrit The vein varies from 16 inches to 3 feet in width, strike about N. 5 W., and dip E. nearly vertical. Adjacent to the vein the wall ro is schistose, but it grades through fine-grained to a coarse-grain gabbro.

There is a total of over 4000 feet of workings and a depth of 2 feet below the outcrop is reached in the winze from the main adit whi is in 500 feet on the vein. The winze is down 145 feet and has dri of 200 feet south at 90 feet; 60 feet south at 130 feet; 30 feet south a 20 feet north at bottom. In the last named the vein is 3 feet wi said to mill $30. Both overhand and underhand stoping has been do A width of 5 feet was stoped, averaging $12 per ton milled, the sch assayed $6 per ton. Though idle when visited (July, 1914) the m was being kept unwatered by the watchman, pumps being driven ompressed air. There is a 50 h.p. motor for the compressor, a 10 .p. motor for the hoist at the winze, and a 15 h.p. motor for the Huntington mill. There are three 23-ton cyanide leaching tanks for ailings treatment. Power is obtained from the San Joaquin Light nd Power Company.

Gilkie (see Delilah Mining Company).

Gilroy Claim. Henry Sullivan, Grabner, owner. This claim is in Sec. 17, T. 10 S., R. 22 E., on Temperance Flat, 3½ miles northwest f Wellbarn Station on the San Joaquin and Eastern Railroad, elevaion 1000 feet (U. S. G. S.). It was located in 1896 and only assessment work done until 1913 when a new ore shoot was struck. The ountry rock is a decomposed granite and the quartz vein carries ree gold, galena and pyrite, stated to mill $27 per ton in free gold. he vein averages 10 inches wide and strikes northeast, dipping 8° NW. The adit showing the new shoot is in 92 feet on the ein with a winze down 45 feet from which ore has been stoped for 0 feet along the vein. There is a 70-foot winze in the older workings. he ore was milled at the John L. mine adjoining, which arrangeent will continue when work is resumed this fall.

Graveyard and Vulture. Ira F. Hawk, owner. Near Pine Ridge. ssessment only.

Hercules (see Delilah Mining Company).

Independence Group (Collins). Bert Sides and Bert Ashbrook, ingriver, R. F. D., owners. This group of three parallel claims djoins the Eliza Jane mine on the southeast, in Sec. 29, T. 12 S., . 24 E., 4 miles north of Piedra; elevation 1000 feet (bar.). There e three veins, the middle one of which is the extension of the Eliza ane, and like it, carries free gold, galena and pyrite in quartz. The all rock is the same hard schist, and the vein is from a few inches 2 feet in width. There are three adits, 100, 60 and 40 feet, and ree shafts, 65, 50 and 45 feet. No stoping has been done as yet, but ifting has yielded a small tonnage of ore of which twelve tons eated in the Eliza Jane mill in February last, gave $25 per ton on the ates. Two men at work.

Robt. Ingelhardt is working a placer claim on Kaiser Creek north Cascada.

Inyo (see John L.).

Iowa, a placer property on the San Joaquin River about 6 miles ove Friant. Idle past eight years. It was worked by ground sluicing, ing a turbine wheel and six 6-inch centrifugal pumps.

Jenny Claim, Olof V. Blom et al., Fresno, owners, P. O. Box 1006. It is in NW. ¼, Sec. 16, T. 13 S., R. 27 E., 5 miles northwest of Millwood. The quartz vein carries principally arsenopyrite, with some pyrite and chalcopyrite, said to assay $15 per ton in gold and silver with a little lead and copper. There is one adit of 115 feet; another 206 feet with 45 feet of crosscut at the end, and a shaft of 50 feet. It is proposed to put in a "Blom Patent Roaster and Fume Condenser" (U. S. Pat. No. 1098611) this fall to treat the ore, of which there is a small tonnage on the dump from development work.

John L. Mine (one time called Inyo, also Martin; known locally as the Sullivan). John Sullivan and Mrs. Henry Sullivan, Grabner, owners. This mine, on Temperance Flat, is in the SE. ¼, Sec. 17, T. 10 S., R. 22 E., 3½ miles northwest of Wellbarn Station on the San Joaquin and Eastern, by a fair road. It was located in 1853 and has been worked more or less regularly ever since—particularly the past thirty years, by Henry Sullivan. It is credited with a total output to date of over $75,000.

The vein, which is a fractured quartz, is between a talcose schist footwall and granite hanging and strikes northeast with dip 41° NW. It is proven for a length of 1500 feet on the surface by cuts and shallow shafts. The pay shoot is 12 to 41 inches wide and stated to be 1000 feet long. The old tunnel was in 1000 feet on the vein but is now caved and the new one 105 feet lower is in 600 feet with 200 feet of it on the vein. A raise is being driven to connect with the upper level. Originally an arrastra was used, and more recently a 1-stamp Kendall mill, steam driven. A 2-stamp Hendy mill, 1000-poun stamps, and a Frue vanner are to be installed this fall. Two men wer at work (August, 1914).

Bibl.: R. VIII, p. 214; X p. 204; XII, p. 129; XIII, pp. 167, 171

Kaiser Creek Diggings (see Dodge, also Ingelhardt).

Keeno and Joseph G. W. D. Coats, Fresno, owner. These are tw patented claims at Temperance Flat. Idle.

Bibl.: R. XII, p. 129; XIII, pp. 167, 171.

Laurel Creek Mines (see Burton, Richter and Wakefield).

Little May Claim. Lawrence Benson et al., Burrough, owner It is on Sycamore Creek, near Trimmer. The quartz vein carryin crystallized gold is in schist. There is a shaft down 40 feet and tunnel in 60 feet.

Little Monitor (see Davis Flat Mining Company).

Low Pocket Mine. Owned by a Mr. Pearson, of Portland, Ore. is in Sec. 28, T. 12 S., R. 25 E., southeast of Trimmer. It was amed because of a pocket of several thousand dollars having been aken out at the surface a few years ago. Two men were at work on levelopment this summer.

M. and M. Mining Company (formerly White Cross). W. A. Maconald, president; G. A. Parker, secretary. Office, Dunlap. This ompany has a bond on the White Cross owned by Reed Bros., Reedley, nd has in addition located several other claims on adjoining ground. he group is in Secs. 3 and 10, T. 14 S., R. 26 E., 1 mile southwest f Dunlap. There are two principal veins, the ''White Cross'' and the Cross'' which intersect. The former, which carries most of the alues, is in schist near a granite contact, the granite being on e footwall side. The gold is mostly free, with some pyrite. On the 00-foot level this vein is stated to show average assays of $26.85 per n for a length of 100 feet, the ore being 6 to 42 inches wide. On the me level the Cross vein is 4½ to 5½ feet wide and assays about $3 per n. They have drifted 130 feet on the shoot and 125 feet on the ross vein. The main adit (upper) is in 600 feet with a 150-foot rtical winze and a 90-foot crosscut at bottom. A new adit has been arted to cut the vein 150 below the bottom of the winze. Idle, ugust, 1914, but work is to be resumed this fall. The former operators cked ore down by burros and sleds to the creek below (one summer out 1894), and put it through a 1-stamp mill, recovering $15,000.

Bibl.: R. VIII, p. 208; XII, p. 131; XIII, p. 170.

Martin (see John L.).

McDuff & McMurty (see Contact M. and M. Company).

Midas Claim. John Anderson, Grabner, and Mrs. E. A. Bonnell, berry, owners. This claim is at Temperance Flat, adjoining the ovidence on the southwest. Anderson is working alone, drifting. ere are two tunnels, 156 and 200 feet. Ten tons of ore recently ated by arrastra at the Providence is stated to have yielded $40 per n. The pay streak is 8 inches wide in a 6-foot vein in granite.

Oro Fino No. 1 and No. 2. Adjoin Delilah at Sampson Flat. Abanned.

Bibl.: R. VIII, p. 207; XII, p. 130; XIII, p. 168.

T. G. Price has been working a placer claim for several seasons on nkey Creek, 7 miles below Forest Ranger Station, about Sec. 3, 11 S., R. 26 E.

rovidence Mine. Logan, Beard & Nelson, of Pine Ridge, owners. is in Sec. 13, T. 10 S., R. 25 E., 2 miles north of west from the nkey Creek Station of the U. S. Forest Rangers. There is a 10-stamp l on the property. Idle several years, except for assessment work.

Bibl.: R. XII, p. 130; XIII, pp. 169, 171.

Providence Claim (formerly Wide Awake). O. F. Sloan and Perry Tyre, Grabner, owners. It is on Temperance Flat, in SE. ¼, Sec. 17, T. 10 S., R. 22 E., 3½ miles northwest of Wellbarn Station on the San Joaquin and Eastern. Elevation 850 feet (U. S. G. S.). It was located in 1908. The vein is an ochreous quartz in decomposed granite. There is a vertical shaft of 50-foot depth, with a 38-foot drift. At 24 feet below the collar of the shaft is an adit in 200 feet. Wire gold shows in the ochre and quartz, the vein being about 8 inches wide. Three men were at work and an arrastra in operation (see photo No. 80). A 12 h.p. distillate engine furnishes power for the arrastra, pump and hoisting.

Photo No. 80. Arrastra and plant at Providence Mine, Temperance Flat, Fresno Count

H. Richter is working a placer claim at Cabin Meadow, in Sec. 1 T. 10 S., R. 26 E., on Laurel Creek, northeast of the Dinkey Cree Forest Ranger Station.

Rico Claim. John Bittern, Trimmer, owner. It is 3 miles north Eagle Peak, north of Trimmer. The vein is reported to be 80 fe wide, with 20 feet of free milling ore assaying $10.50. There a three adits, 20, 40 and 60 feet. The footwall is stated to be serpenti and the hanging, slate.

Rosa Claim. T. S. and H. Schell and E. Bailey, owners, Hugh Creek via Sanger. It is in Sec. 18, T. 12 S., R. 24 E., 6 miles nor of Piedra. The claim has been located and relocated several times the past thirty years, and by the present owners in 1912. It is stat there are two veins at a contact between granite and schist. The are two adits, each in about 100 feet, one being a drift. The cro cut has not yet cut the vein. Assessment work only.

San Joaquin Claim. W. G. Walker, J. B. Baker and Dr. C. H. ower, owners; home office, Friant. It is located at Temperance Flat, n Sec. 17, T. 10 S., R. 22 E., 4 miles northwest of Wellbarn Station n the San Joaquin and Eastern railroad. Elevation 1350 feet U. S. G. S.). This claim has been worked at intervals for some years, nd by the present owners since April, 1914. The quartz vein is in ecomposed granite, carrying free gold with some sulphides; strike ortheast and dip 20° to 30° NW. The gold is stated to assay $14 er ounce. There is an incline down 100 feet on the vein and an adit elow in 40 feet. A raise is being driven to connect the two. A 6 p. distillate engine runs the arrastra, which treats 2 tons of ore er twenty-four hours. Distillate costs approximately 14 cents per allon at the mine, 4 cents of which represents the freight from Wellarn Station to the mine. Two men were at work.

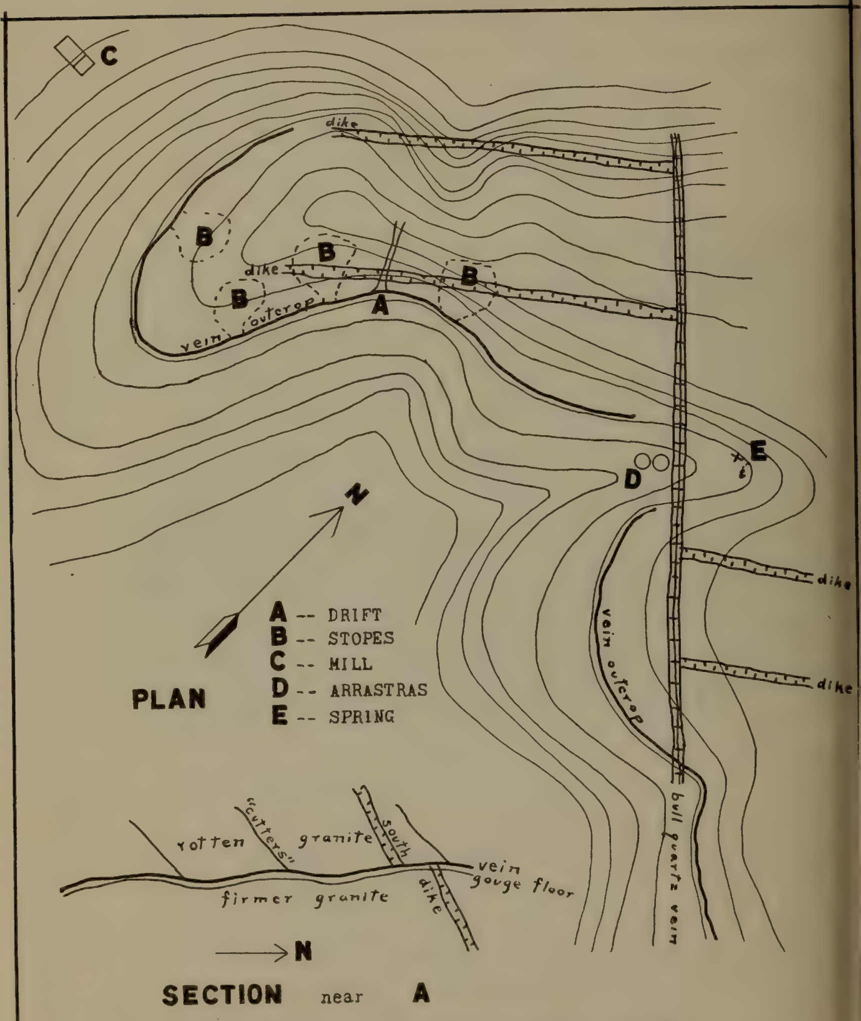
San Joaquin Rock and Gravel Co. (See under Stone Industry.)

John Ship and *Mr. Ward* have a quartz claim at Sample Meadow, bout Sec. 18, T. 7 S., R. 26 E., north of Cascada (Big Creek post ffice). Assessments only.

Sullivan (see John L.).

Sunnyside Group. Sunnyside Gold Mining Company, owner; Edgar an Meter, president; G. G. Parsons, secretary; L. B. Chenoweth, perintendent; office, Land Company Building, Fresno. This group in the old ‘‘Sycamore District,’’ now locally called Hughes Creek. is located in Sec. 21, T. 12 S., R. 24 E., 18 miles northeast of anger and 5 miles north from Piedra Station of the Santa Fe Railad. Elevation 1250 feet (bar.) at the mill, the mine workings being 0 feet higher. There are ten unpatented claims, first located over irty years ago, but not much work done until 1903. All the gulches elow have been placered.

The vein is flat, with occasional rolls and troughs and a slight dip the south (see sketch map). The country rock is granite, the nging-wall being softer and more decomposed than the footwall. here is an impervious clay gouge on the floor, which apparently preented the waters, circulating along the fissure, from going into e granite below. The vein is from a few inches to 2 feet in width, nd the gold is principally free, with some pyrite. High values are casionally found in ochreous bunches. In the northern part of the ea shown in the sketch map, outside of the vein as indicated, no gouge mineralization has been found. The vein does not come to the rface on the north side of the hill. The dikes are aplite, and dip eeply to the north, the south one being displaced by the vein. Both



SKETCH MAP of SUNNYSIDE MINE

FRESNO CO.

dikes are faulted by a heavy vein of bull quartz, which strikes northwesterly. The drift at "A" is being driven to crosscut the north dike and ascertain if the flat vein stops altogether or dips to the northwest and goes down steeper.

In the decomposed granite, which is partly granular in places, they use a 1¼-inch auger with ratchet and pressure drill. From 35 to 50 feet of holes per man per shift are drilled, and a special low Hercules 15 per cent powder is employed. In stoping, the ground is allowed to cave behind the work. The milling equipment includes a 2-stamp Krogh mill, with amalgamated plate 4 feet by 10 feet. Power is furnished by a gasoline engine. Six men were at work in July. The mine is credited with a total production to date of approximately $40,000, of which $17,000 was taken out from a single pocket and reduced in the arrastras.

Temperance Claim. Mrs. W. A. Field, Oakland, owner. This is a patented claim at Temperance Flat, northwest of Wellbarn. Idle.

Bibl.: R. XII, p. 131; XIII, p. 170.

Vulture (see Graveyard).

William Wakefield is working a small placer property in Sec. 13, T. 10 S., R. 26 E., on a branch of Laurel Creek, 4 miles due east from the Dinkey Creek Forest Ranger Station. Elevation 7000 feet (U. S. G. S.).

White Cross (see M. and M. Mining Company).

Wide Awake (see Providence, Temperance Flat).

GRAPHITE.

On the *E. D. Kean* ranch, in Sec. 12, T. 14 S., R. 24 E., 4 miles east of Squaw Valley post office, there is a deposit of graphitic schist. It has more or less quartz with it and is too impure to be of commercial value. There is also a similar occurrence on the Ruth ranch farther east.

A 15-inch vein of graphite is reported on Sycamore Creek near Trimmer, but we have not seen any samples of the material.

Bibl.: R. XIII, p. 642; Bull. 38, p. 280.

GYPSUM.

Gypsum is a hydrous calcium sulphate. Its color ranges through white, gray, yellow and red to darker shades, according to purity; and it is found massive, granular, fibrous and crystalline. Calcium ulphate occurring without water of crystallization is the mineral nhydrite. The uses of gypsum are many and varied. Calcined, it is used as plaster of paris, and replaces lime for hardwall plasters. It is used as a retarder in the manufacture of Portland cement and in the preparation of fertilizers. It is also utilized in the paper, glass, dyeing and other industries. As a fertilizer, it is stated to be valuable in reclaiming "black alkali" land.

Coalinga Deposits. There are two deposits near Coalinga, one about 9 miles to the north and the other at the old San Joaquin Valley coal mine in Sec. 26, T. 20 S., R. 14 E. At one time a considerable tonnage of gypsum was shipped from both these properties, but they have now been idle several years.

Bibl.: R. XII, p. 323; XIII, p. 503; Bull. 3, p. 63; Bull. 38, p. 283.

Paoli Mine. A. P. Sheppard, C. S. Pierce et al., Fresno, owners. This deposit is on patented ground in Sec. 13, T. 15 S., R. 12 E., about 18 miles southwest of Mendota on the Southern Pacific. It was worked for a number of years and a considerable tonnage of gypsum shipped ground, for fertilizer purposes. On account of the expensive haul to the railroad the property has been idle the past four years.

Bibl.: R. XII, p. 323; XIII, p. 503; Bull. 3, p. 63; Bull. 38, p. 283.

Paul Schuck, of Fresno, has a deposit of gypsum on the west edge of T. 14 S., R. 12 E., from which shipments were being made via Firebaugh on the Southern Pacific, up to the end of 1913. Idle in 1914.

INFUSORIAL EARTH.

A. P. Sheppard, of Fresno, has a deposit of infusorial earth of good quality in T. 15 S., R. 12 E., southwest of Mendota.

LIME AND LIMESTONE.

Limestone occurs in T. 12 S., R. 26, 27 and 29 E., east of Trimmer, on the north side of the Kings River, also at Sampson's Flat, south of the river and north of Dunlap. Owing to their distance from a railroad these deposits are undeveloped.

Lime was at one time burned in a shaft kiln about ½ of a mile south of Dunlap and near the White Cross mine, but none has been produced for several years past.

Bibl.: R. VIII, p. 208; X, p. 185; XIII, p. 628; Bull. 38, p. 328.

MAGNESITE.

Magnesite is magnesium carbonate, $MgCO_3$, color snow-white to brown, hardness 3.5 to 4.5, sp. gr. 3.0 to 3.12. It is of frequent occurrence in the serpentine areas of California, particularly in the Coast Range, but also in the Sierran section, where the deposits in Fresno and Tulare counties are found.

The industrial uses for magnesite are many and varied, and the demand will no doubt increase materially in the next few years, particularly now that the Panama Canal gives the California product a cheaper entry into the eastern markets. For most purposes magnesite is calcined before using. The largest tonnage at the present time is used in the manufacture of bricks for the lining of basic Bessemer converters, both in steel and copper smelters. It is also employed in copper reverberatories, and other special metallurgical furnaces, such as for handling bullion, silver slimes, electric smelting, heating, welding and melting furnaces, calcium carbide kilns, and in the burning zone of rotary kilns in Portland cement plants.

Not as high a purity of material is necessary in furnace liners, particularly for steel, as in some other uses, for in the case of basic open hearth steel furnaces, while the magnesite must be free (or at least very low) from silica, it can carry a noticeable percentage of iron oxide or serpentine without impairing its efficiency. In fact, by some it is considered an advantage, as such impurities permit the sintering of brick at a lower temperature than is possible with pure magnesite. ''Dead-burned'' magnesite—that from which all the CO_2 has been expelled—is hard to handle, having little or no plasticity. Its plasticity is said to be improved by adding partly calcined or caustic magnesite.

Another extensive and expanding field for the employment of magnesite is in the manufacture of artificial stone, flooring, tiles, wainscoting, etc. These products are put on the market under various trade names, among which may be mentioned: idealite, marbeloid, monolith, karbolith, chemolith, etc. The magnesite floors being put in Pullman and other steel railroad coaches are of such products. The reaction made use of is that a moistened mixture of MgO and $MgCl_2$ will form a strong cement (known as oxychloride or Sorel cement). There should be an absence of lime, as calcium chloride is hygroscopic and on hydrating swells, destroying the usefulness of the material. Soluble silicates of the nature of ''water glass'' are also used with the magnesia. A similar magnesia cement is used as a paint, but of course applied thin with a brush. ''Porcelith'' and ''Liquid Stone'' are two brands prepared by San Francisco firms from California magnesite. For use on wood, where it acts as a fire retardant, it may be mixed still thinner and sprayed on.

In the ''sulphite'' process of paper manufacture, calcined magnesite is used as a carrier of SO_2 gas in the digester. The uses of the carbonic acid gas derived from calcining magnesite are well known, carbonating beverages, refrigeration, etc. For these purposes it is liquefied by compression, to facilitate its transportation. At the present time, however, as lime rock is obtained more cheaply and the calcined residue is more readily marketed, no magnesite is being used on the Pacific Coast for the manufacture of CO_2. There are many other uses which will not be detailed here.

Production of magnesite in Fresno County began in 1904, with 38 tons reported, and the total recorded yield of the county to the end of 1913 has been 5643 tons, valued at $62,295 for the crude material at the mines.

Bibl.: Bull. 38, p. 327; Bull. 67, pp. 92, 93; U. S. G. S., Bull. 355 and 540, "CEMENTS, LIMES AND PLASTERS," E. C. Eckel, 1905, pp. 149–167.

Photo No. 33. Plant of Fresno Magnesite Company, Piedra, Fresno County.

Fresno Magnesite Company (one time locally called Bachler). M. F. Tarpey, president; A. B. Tarpey, secretary; office, Tarpey post office. This group of forty unpatented claims is principally in Sec. 5, T. 13 S., R. 24 E., ½ mile north of Piedra and on the opposite side of the river. Piedra is the terminus of the Santa Fe's Reedley-Piedra branch line. It was first worked in 1905, and most of the output to date from Fresno County has come from this property. The shipping point was formerly Sanger, a 15-mile haul, but since Hess' report* the Santa Fe branch above mentioned has been built and also an excellent steel bridge crossing the Kings River below the mine. The entire product has been shipped to the Hawley Pulp and Paper Company at Oregon City, Oregon. The haul from mine to rail costs 60¢ per ton, and a car per day can be loaded with one 4-horse team.

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*U. S. G. S., Bull. 355, p. 51.

The magnesite occurs in a series of fissure veins in serpentine and metamorphic ferro-magnesian rocks. The main vein, which is 8 to 10 feet wide, strike W. of N., dip E. 50°, is developed by adits and has been worked by stoping. On the footwall it is more or less mixed with waste. The equipment includes a shaft furnace (see photo No. 33), fired by crude oil, with a capacity of approximately 25 tons per day. When operated, twenty men are employed. There was only a watchman on the property when visited (July, 1914).

Bibl.: Reports X, p. 185; XIII, p. 505; Bull. 38, p. 328; Bull. 67, p. 93; U. S. G. S., Bull. 355, pp. 50, 51.

Magnesite boulders have been noted in the "Big Blue" beds in the eastern foothills of the Diablo Range, between Cantua and Salt creeks, about 18 miles west of north from Coalinga. "They are not believed o represent an accumulation in any commercial quantity, but are menioned only because they point to the presence of magnesite in the serpentine area on the west and prove that at least some of the magnesite veins originated in or prior to the early Miocene."*

L. F. Ward of Hopkins and Fourteenth avenue, Oakland, has a group f claims on a magnesite vein south of Kings River at Piedra, opposite o the mine of the Fresno Magnesite Company, and about ¾ of a mile distant south. The vein, about 8 feet wide, has an east-west strike and s developed principally by a series of shallow surface cuts, also a short tunnel. It is favorably situated for building a gravity tramway to and its product at the tracks of the Santa Fe a short distance below t. The magnesite appears to be of good quality.

Bibl.: U. S. G. S., Bull. 355, pp. 50, 51.

MARBLE

Ellison Bros., of Fresno, have claims located on a marble deposit on Big Creek, near that of the San Joaquin Marble Company, described below.

San Joaquin Marble Company, Emery Wishon et al., Fresno, owners. hese claims, covering 125 acres, are in Sec. 36, T. 8 S., R. 24 E., on he south side of Big Creek, 5 miles below Cascada, the terminus of he San Joaquin and Eastern Railroad. Elevation 4000 feet (U. S. . S.) The marble is only 2000 to 3000 feet from the railroad track, nd 500 feet lower in elevation. There is ample electric power at hand, s the deposit is between the two power plants of the Pacific Light and ower Company, whose main transmission line passes near-by. Only inor development work has been done as yet, but marble of good quality and the following colors is disclosed: white, blue, variegated and black. It occurs as a lens in a granite country and runs northwesterly, crossing Big Creek. Its limits were not fully determined, but it appears to be at least 200 feet wide by ½ mile long.

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*U. S. G. S., Bull. 540, p. 509.

MINERAL WATER.

While not generally known as a mineral springs county, Fresno has several groups of springs, both hot and cold. They are found both in the Coast Range at the western end, and in the Sierra Nevada Mountains as well.

Balsam Grove Springs. This group in Sec. 32, T. 8 S., R. 25 E., is in the Sierra National Forest, and the operators, W. H. Thrower and Louis S. Budo, have a 10-year lease from the Forest Service for resort privileges. The post office is Big Creek. The hotel is ¼ of a mile from Carlson Station on the San Joaquin and Eastern, at an elevation of 4500 feet (U. S. G. S.). It is in a picturesque and well timbered country, there being an abundance of pine, fir, cedar and oak. There are three "iron" and one "white sulphur" springs, all cold. No water is bottled. The hotel and housekeeping tents will accommodate 120 people. This season, 1914, which was their first, having been a successful one, the lessees propose to enlarge their facilities for 1915

Blaney Meadows Hot Springs are at the upper end of Blaney Meadows on the South Fork of the San Joaquin River, in Sec. 14, T. 8 S. R. 28 E., elevation 7600 feet (U. S. G. S.). There are four smal springs with a maximum temperature of 110° F. and a total flow o about 40 gallons per minute. Analysis by the United States Geologica Survey shows the total solids to be 780 parts per million, principall sodium chloride. The springs are not utilized except by occasiona camping parties.

Bibl.: U. S. G. S., Water Sup. Pap. 338, p. 54.

There is a carbonated spring at the eastern end of Fish Valley, 1 miles by trail southward from Soda Spring Flat. It is at the corner o the four townships, 4 and 5 S., Rs. 26 and 27 E.

Bibl.: U. S. G. S., Water Sup. Pap. 338, p. 239.

Collins Spring (see Millerton).

Fresno Hot Springs. Kreyenhagen Estate, Coalinga, owner. Em and Chas. Kreyenhagen, executors. These, the oldest commerciall utilized mineral springs in Fresno County, are in Sec. 34, T. 20 S R. 13 E., 12 miles due west from Coalinga and 18 miles by road. The are on a hillside about 100 feet above the creek in Hot Springs Canyo There are five springs, sulphuretted, with temperatures from 88° t

7° F. A bathhouse and hotel were built some years ago at a cost of 11,000, and the property was leased as a resort up to 1914. It has een idle this year, owing to the heavy rains of last winter having ashed out a considerable portion of the road up the canyon.

Bibl.: R. X, p. 189; XII, p. 333; XIII, p. 510; U. S. G. S., Bull. 32, p. 204; Water Sup. Pap. 338, p. 78; "MINERAL SPRINGS AND HEALTH RESORTS OF CAL.," WINSLOW ANDERSON, 1890, p. 135.

Lower Mineral Hot Springs. James E. Hughes, 630 Mandana boule- ard, Oakland, has a lease from the U. S. Forest Service on the meadow ontaining this group of springs. They are on the South Fork of San oaquin River, in Sec. 15, T. 7 S., R. 27 E., about 10 miles below e Blaney Meadow hot springs. They are reached by trail from ascada and from Shaver, and are used privately and also by occa- onal camping parties. There are six springs, the hottest showing temperature of 112° F.

Bibl.: U. S. G. S., Water Sup. Pap. 338, p. 55.

Mercey Hot Springs. Mercey Mineral Springs Company, owner. . J. Bourn, president; M. Nuckolls, secretary. Office, Humboldt Bank uilding, San Francisco. W. Y. Bourn, manager at the springs. hese springs are on Little Panoche Creek, in Sec. 15, T. 14 S., . 10 E., 25 miles southwest of South Dos Palos, and 30 miles from Los años, which is their post office. Elevation 1200 feet (U. S. G. S.). hey are located among the barren hills bordering the western edge the San Joaquin Valley, and for many years were used to supply eep watering troughs. There has been a resort there for about fifteen ars, and the present company has had it since March, 1913. It is uipped with a small hotel and a number of tents, accommodating in l about sixty people. It is intended to improve the facilities in the ar future. The main spring has been excavated, forming a reservoir out 15 feet square, which is lined with concrete. In the pool the water s a temperature of 111° F., while at the bathhouse some 250 feet dis- nt the temperature is 108°. The principal constituent is sodium loride, the water being slightly sulphuretted and there is a little excess s at the spring. The water was at one time bottled for sale but not at esent. The resort is open throughout the year and an automobile rries guests between Los Baños and the springs.

Bibl.: R. XIII, p. 510; U. S. G. S., Water Sup. Pap. 338, p. 78.

Millerton Spring (locally known as Collins). J. D., A. S. and W. G. llins and J. Musick, owners. It is in Sec. 4, T. 11 S., R. 21 E., on the San Joaquin River, 2 miles northeast of Friant. Elevation 350 feet. (U. S. G. S.) There is one sulphur water spring issuing from a crevice in the granite bedrock near the river's edge. It has been known since the placer mining days of 1856, old Fort Miller and Millerton having been less than a mile east of here, but the spring has been used for resort purposes only since 1907. The temperature is 71° F.; the flow 17,000 gallons per twenty-four hours; and there is a little excess sulphuretted hydrogen gas. The spring is walled in by a cement curb and the water pumped to a cement tank, then heated for bathhouse use. Analysis shows 682 parts per million total solids, principally sodium and calcium chlorides, with 5.2 cc. H_2S per liter. Accommodations include eighteen tent cottages and a twenty-room hotel.

"Sulphur Baths." Santa Rosa Oil and Development Company owner. Charles L. Smith, president; R. Whitehead, managing director. Office, 205 First National Bank, Oakland. This well, whic is in Sec. 12, T. 21 S., R. 14 E., 3 miles southwest of Coalinga, wa drilled in 1906 for oil but obtained an artesian flow of sulphur water The following figures are from the log of the well:

1352 to 1360 feet, dark running sand;
1409 to 1421 feet, sand and shale (good oil);
1435 to 1439 feet, sand showing oil;
1440 to 1445 feet, sand and shale carrying oil;
1570 to 1585 feet, good oil sand;
1600 to 1630 feet, oil sand;
2057 to 2077 feet, white shell;
At 2077 feet, flowing sulphur water.

The flow was originally 6000 barrels per day, but at present it i only 1800 barrels per day.

The temperature of the water is 118° F. as it issues from the wel and it is accompanied by an inflammable gas which is utilized fo illuminating purposes about the grounds. The water discharges int a cement-lined tank 75 feet long by 59 feet wide by 10 feet dee which serves both as a reservoir head for the service pipes and as swimming pool. There are twenty dressing rooms ranged around thr sides of the pool, part of which is roofed over. The water is piped Coalinga and parts of the oil fields for boiler purposes. It does n scale in the boilers as does most of the other waters obtainable in th region. The cost of operating is only nominal and the company h been paying dividends regularly, being in this respect more fortuna than many of the "oil" companies.

The following is an analysis of the water from this well, made by Smith, Emery & Company, San Francisco, for the Producers' Transportation Company:

Feed Water Analysis.

Analysis of solids	Grains per U. S. gallon	Incrusting solids	Grains per U. S. gallon
Suspended matter Silica (SiO_2)	.76	Suspended matter Silica	.76
Iron oxide and alumina (R_2O_3)	Nil	Iron oxide and alumina	Nil
Lime (CaO)	2.61	Calcium carbonate	4.49
Magnesia (MgO)	1.47	Calcium sulphate	.23
Soda (Na_2O)	29.55	Calcium chloride (corrosive)	Nil
Sulphuric anhydride (SO_3)	.81	Magnesium carbonate	2.75
Chlorine (Cl)	2.33	Magnesium chloride (corrosive)	Nil
Carbon dioxide (combined CO_2)	22.72		
Volatile and organic matter	9.35	Total	8.23
Total solids	69.60	Non-incrusting solids:	
Alkaline	Yes	Sodium carbonate	46.52
Acid		Magnesium sulphate*	.45
Hydrogen sulphide (H_2S)		Sodium sulphate	.68
		Sodium chloride	3.85
		Volatile and organic matter	9.35
		Total	60.85

*NOTE.—Magnesium sulphate forms some scale in presence of calcium carbonate and sodium carbonate.

There is a *sulphur spring* in Sulphur Meadows, ½ mile south of the Shaver lumber mills, in Sec. 19, T. 9 S., R. 25 E. It is utilized only locally.

Bibl.: U. S. G. S., Water Sup. Pap. 338, p. 286.

Three Springs, while not "mineral," are yet worthy of mention. They are in Sec. 20, T. 11 S., R. 28 E., on a ridge between the north and main forks of Rancheria Creek, and beside the trail from the Dinkey Creek Ranger Station to Tehipite at the point where the Statum Meadow trail branches off. As the name indicates, there are three, arge perennial springs within a short distance of each other, having a ine flow of clear cold water. They are used as a wayside camping pot by parties traveling through that part of the Sierras.

Bibl.: U. S. G. S., Water Sup. Pap. 338, p. 338.

Trimmer Springs. Trimmer Estate, owner; Morris Trimmer, Kingsburg, president; Wm. Terrill, renter. This group is in Sec. 18, T. 2 S., R. 25 E., on the Kings River, 14 miles northeast of Piedra, and of a mile south of Trimmer post office. It was formerly operated as resort, but not since 1911. There are four springs yielding iron, magnesia, and sulphur water. All are cold. They are in a picturesque egion.

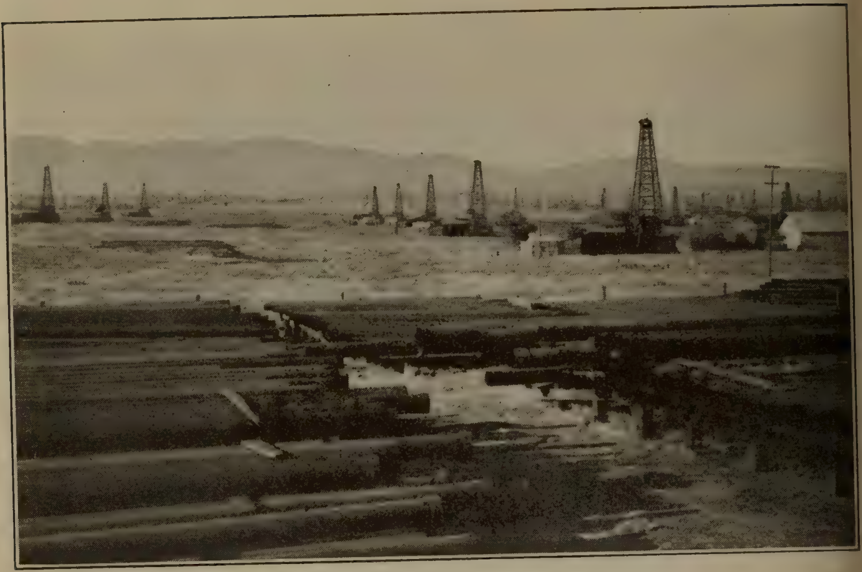

Photo No. 113. Coalinga Oil Field, Fresno County, California, looking north from Associated Oil Company on Section 36.

Photo No. 114. Oil loading rack, Crump Siding near Coalinga, Fresno County.

NATURAL GAS.

There is more or less natural gas in nearly all of the oil wells of the Coalinga field. At some it is not utilized at all, while at others it is collected in gasometers and used for lighting, for fuel under boilers and in operating gas engines. The Turner Oil Company manufactures gasoline by compression from the gas of its wells at Coalinga. An inflammable gas has also been obtained in drilling for water northeast of Mendota.

Bibl.: R. VII, p. 65; X, p. 189; XI, p. 210; XII, p. 348; XIII, p. 567; Bull. 3, p. 20; Bull. 19, p. 183; Bull. 69; U. S. Bureau of Mines, Bull. No. 19.

NICKEL.

Nickel has been reported from Fresno County, but an analysis made in the laboratory of the State Mining Bureau on a sample of the supposed ore showed it to be californite, a green variety of vesuvianite.

PETROLEUM.

The Coalinga field is the only producing oil district in Fresno County. Of the total recorded mineral product of $66,294,637 for the county to the end of 1913, the sum of $62,130,959, or 94 per cent, represents the value of petroleum yielded. Oil production began in 1890 but was of small amount until 1896. For a time Fresno was the premier county of the State in petroleum output, and it now takes second place only to Kern, both in point of annual yield and of total amount to date.

The Coalinga district is approximately 50 miles long (north and south) by 15 miles wide, covering some 700 square miles on the western edge of the San Joaquin Valley and the eastern foothills of the Diablo Range. A detailed description of the district will not be entered into here as it has recently been covered very thoroughly by R. P. McLaughlin and C. A. Waring of the State Mining Bureau in Bulletin No. 69, ''Petroleum Industry of California'' (*q. v.*).

During 1913 there were 147 operating companies in the Coalinga field, with 1136 completed wells, of which 915 were producing, in an area of 22 square miles of proved oil land. The yield for 1913 was 18,956,965 barrels, valued at $7,927,736 at the wells.

Bibl.: R. VII, p. 65; X, p. 189; XII, p. 352; XIII, p. 571; Bull. No. 3, 15, 19, 31, 32, 69; U. S. G. S., Bull. 398. A more extended bibliography on petroleum in Fresno County is given in Bull. No. 69 of the State Mining Bureau.

PUMICE (see under Volcanic Ash).

QUICKSILVER.

Arambide and Aurecoechea Claims (see Pacific Quicksilver Company).

Archer Mine. Joe Byles, Coalinga, owner. This claim, located in 1904, is in Secs. 2 and 3, T. 18 S., R. 13 E., 24 miles northwest of Coalinga, and near the Mexican mine. A small amount of quicksilver has been produced, using a retort consisting of six 9-inch pipes. It is stated that the ore retorted yielded 10 to 20 per cent metal, but that there is considerable low grade material in sight. The ore carries cinnabar and pyrite. The country rocks are serpentine and slate. There are five tunnels ranging from 20 to 150 feet in length, and several open cuts. But little more than assessment work is maintained.

Photo No. 105. Furnace at Pacific Quicksilver Mine, Fresno County.

Mercy Group. Mercy Bros., Llanada post office, owners. This group of three claims adjoins those of the Pacific Quicksilver Company on the northwest. Located about 1904. Development consists of several short adits. Assessment only.

Mexican Mine. Antonio Urrutia et al., Panoche, owners. This group of three claims in Sec. 22, T. 18 S., R. 13 E., northwest of Coalinga, was originally located in the sixties. Development work consists of several adits and some surface cuts. The vein is in sandstone and

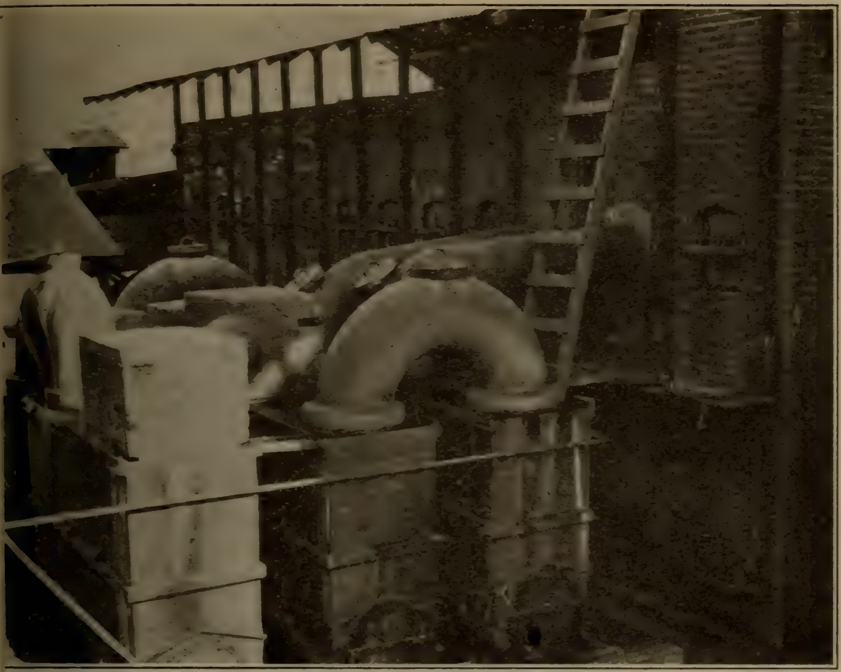

Photo No. 106. Condensers at Pacific Quicksilver Mine, Fresno County.

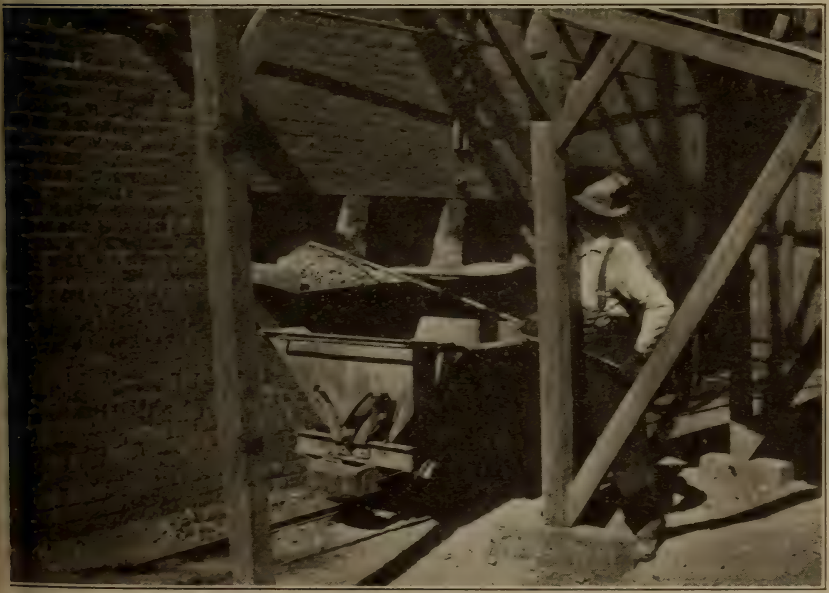

Photo No. 107. Drawing off burned ore, Pacific Quicksilver Mine, Fresno County.

carries cinnabar associated with silica and oxides of iron, the oxidation product of iron sulphides. Only assessment work has been done of recent years.

Bibl.: Bull. 27, pp. 119, 120.

Pacific Quicksilver Company (includes properties formerly known under names of Providential, Arambide and Aurecoechea, Mercy, Croxon.) E. Augustus Waldron, president; Alfred C. Eaton, secretary. Office, Elks' Building, San Jose. This group includes eighteen claims and five mill sites on a branch of Little Panoche Creek, in Secs. 32 and 33, T. 13 S., R. 10 E., and Sec. 5, T. 14 S., R. 10 E., 25 miles southwest of South Dos Palos on the Southern Pacific Railroad. Elevation 1600 to 2000 feet (U. S. G. S.). The present company has had the property since 1911. The country rock is principally a metamorphic sandstone, and the ore occurs in a series of leached zones with quartz and ochre. Relatively little cinnabar can be seen except on panning, when the ochreous material is observed to yield a good percentage of concentrate. There is a little pyrite with the cinnabar.

Formerly the principal work was done on the Providential and Gabilan claims, but when visited (September, 1914), the ore supply was being drawn from the Arambide from a new shoot uncovered last spring. Here the values occur in a series of small veins and stringers over a width of 24 feet, striking east of south and dipping about 60° E. On this claim there is a 100-foot shaft and 400 feet of adits; and on the Aurecoechea 3000 feet of work, including a 150-foot shaft.

The reduction equipment includes a 24-ton Scott fine ore furnace (see photo No. 105), and two "D" retorts with a capacity of 300 pounds each. They are oil fired. Crude oil costs 88 cents to $1.10 per barrel delivered at South Dos Palos, plus $1.17 per barrel freight to the mine. The furnace is 4 tiles long, 50 tiles high, with a 4-inch spacing. The condensers consist of 14 brick chambers and 6 Knox-Osborne cast-iron chambers, the latter being connected in between No. 2 and No. 3 of the brick series (see photo No. 106). From the mine the ore is hauled about ¼ mile in a bottom dump wagon onto an ore bin, from which it is trammed to the jaw crusher (run by a small steam engine), then trammed to the furnace. The burned ore is drawn off into a side-tipping steel car (see photo No. 107) and trammed to the dump. There were seventeen men employed.

Bibl.: Bull. No. 27, pp. 119, 121; U. S. G. S., Mon. XIII, p. 380
Min. Res., 1912, Pt. I, p. 939; 1913, Pt. I, p. 204.

Providential (see Pacific Quicksilver Company).

STONE INDUSTRY.

Under this heading for the purpose of simplifying the statistical reports, the State Mining Bureau now classifies the following closely allied branches of the mineral industry: granite, paving blocks, macadam, concrete, rubble and crushed rock of all kinds, sand and gravel. In the earlier reports these materials were handled separately, but from the standpoint of the producer there is so much overlapping that it has been found more satisfactory to group them.

Academy Granite Company. J. S. Williams, San Jose, president; F. M. Blanchard, Fresno, manager. Office, 215 Griffith-McKenzie Building, Fresno. Quarry address, Academy post office. This quarry is in Sec. 13, T. 12 S., R. 22 E., 11 miles northeast of Clovis, on the Southern Pacific Railroad, and was opened up in 1903. The stone, as determined by a microscopic examination of a thin section, is a dark, hornblende diorite, but locally called "black granite." The color permits of a fine contrast of polished and unpolished surfaces, which makes it excellent for monumental and decorative purposes. It is medium grained, and is harder than the lighter granites such as the Raymond granite in Madera County. This makes it more expensive to cut.

So far as uncovered, the stone occurs in large, rounded boulders of disintegration, the quarry cut being as yet shallow (see photo No. 82). The stone at the eastern edge of the property is darker than that on the west. Pneumatic tools are used, power being furnished by distillate engines. The dressing and polishing is done in the sheds at the quarry, except for stone sold in the rough to other dealers. The product is hauled by wagon to Clovis (see photo No. 84). The largest block shipped weighed 16,800 pounds. Ten men were employed. Stone cutters receive $5 per day and quarrymen $3. The year 1913 was not a particularly active one, but improvement is reported for 1914.

Bibl.: Bull. 38, p. 26.

Boger Gravel Pit. D. and J. R. Boger, Friant, owners. This pit is in the SE. ¼ of SE. ¼, Sec. 7, T. 11 S., R. 21 E., at Friant, with a side track from the Southern Pacific Railroad. Work began here in 1900 and was for several years under lease to the Worswick Street Paving Company. The deposit is an old river bench above the present San Joaquin River bottoms. There are 7 to 15 feet of gravel, underlaid by 3 to 6 feet of clay (said to be suitable for pottery) below which are 36 feet of gravel reported to be gold bearing. Boger is considering putting in steam shovels after the clay is removed, to work the lower gravel for gold. The upper gravel, which is fine to medium, is moved by Fresno scrapers to a loading

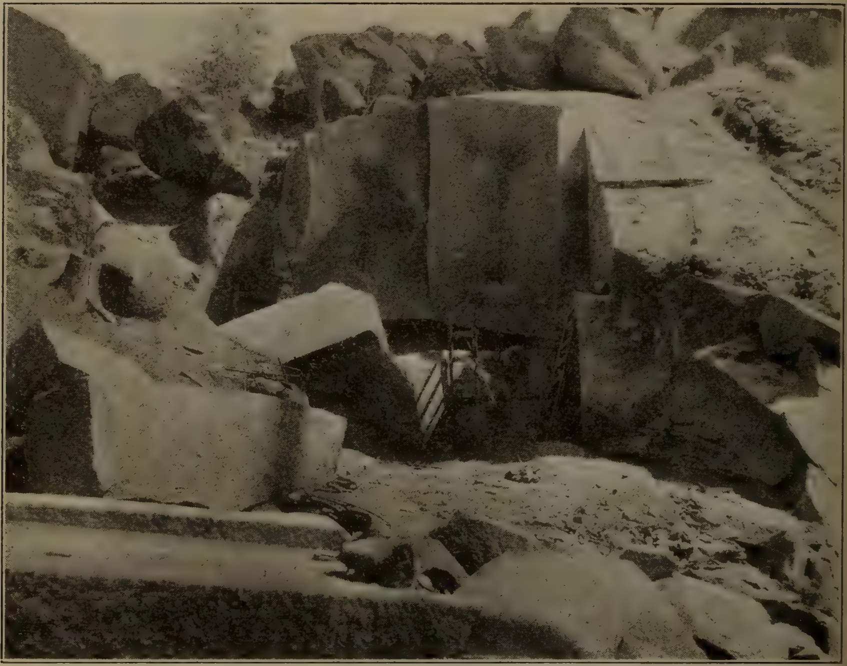

Photo No. 82. In the quarry of Academy Granite Company, near Academy, Fresno County.

Photo No. 84. Block of stone (13,280 pounds) from Academy Granite Company, Fresno County.

pocket and then trammed to the railroad cars. It is not screened at present. Only one man was at work in August, though earlier in the year a larger force was employed.

California Road and Street Improvement Company (formerly Worswick Street Paving Company). R. D. Chittenden, president; P. E. Ludvigsen, secretary. Office, 218 Holland Building, Fresno. This pit is in Sec. 25, T. 11 S., R. 20 E., at Gravel Station on the Southern Pacific, 3 miles west of south from Friant. It has been worked by the present company since early in 1913. The gravel bed is on a bench above the present level of the San Joaquin River, but lower than the Boger gravel above described. The overburden varies from nothing to 6 feet in depth, and the gravel is about 15 feet deep. Five two-horse Fresno scrapers move the material to a pocket, from which it is elevated by a belt conveyer to the screening plant driven by a 100 h.p. electric motor. Two sizes only are made—sand, and up to 2½-inch ring, the oversize being crushed. Some is shipped without screening. There is considerable coarse material, consisting of diorite, basalt and various porphyritic rocks and some flinty material. The selling price is 40 cents, 45 cents and 50 cents per ton, f. o. b. Gravel Station. The capacity of the plant is 15 carloads (550 tons) per day, with average shipments of about ten cars daily. There were eighteen men and a foreman employed.

Doyle, Gill, Doyle & Company. Joseph Gill, manager. This company at Clovis operates a small ''granite'' quarry near the Academy quarry, 11 miles northeast of Clovis, under lease from N. Musick. The stone is the same, black, hornblende diorite occurring as large rounded boulders of disintegration at the surface, but more massive below. At the quarry a hand-operated derrick is used, while at the cutting sheds at Clovis, pneumatic tools are employed, electricity furnishing the power. Four men were at work in the sheds, the quarry being temporarily idle when visited in August.

Kings River Quarry. Atchison, Topeka and Santa Fe Railway, owner, leased to the Sharp & Fellows Contracting Company, 533 Central Building, Los Angeles; John Steigh, superintendent at the quarry. The quarry is in Sec. 8, T. 13 S., R. 24 E., on the Kings River at Piedra, the terminus of the Santa Fe's branch line from Reedley. Elevation 600 feet (bar.). It was opened up in the latter part of 1910, and there is now a quarry face over 100 feet high and 1000 feet wide. The rock is a fine-grained, blue-black basalt, partly in process of serpentinization. It is broken down by bank blasting, using both the ''coyote hole'' method and a drilling rig (air operated) on top of the bank. Firing is done by electricity.

A steam shovel loads the rock onto dump cars, which are drawn by a ''dinkey'' locomotive and discharged directly onto a No. 10 gyratory crusher. This crusher is driven by a 175 h.p. motor. The oversize is recrushed by smaller gyratories. The product is screened to four sizes, from $\frac{3}{8}$ to $2\frac{1}{4}$ inches. Equipment includes besides the crushers, belt and bucket elevators, two steam shovels and two dinkey locomotives. The shovels and locomotives burn oil, while electric power for the other parts of the plant is obtained from the San Joaquin Light and Power Company. The capacity is 1500 tons per day and an average of forty men are employed. The product is sold for road metal and concrete work and is loaded directly from the bins to the railroad cars (see photo No. 32).

Photo No. 32. Loading railroad cars at Kings River Quarry, Piedra, Fresno County.

San Joaquin Rock and Gravel Company. E. A. Forthcamp, president; C. Murray, secretary and manager. Office, 224 Edgerly Building, Fresno. The property is owned by A. G. Wishon and W. E. Durfy of Fresno, the company operating under a lease. It is in Sec. 18, T. 11 S., R. 21 E., 1 mile southwest of Friant, with a spur track from the Southern Pacific Railroad. This bed of gravel, about 30 feet thick, forms a bench above the present level of the San Joaquin River, being on the same bench as the California Road and Street Improvement Company farther south. Elevation about 345 feet (S. P.). The overburden averages 2½ feet. The plant has been enlarged and improved this summer (see photo No. 67). Electric power is obtained from the San Joaquin Light and Power Company. Fresno scrapers move the material to the belt elevator. It is then screened and washed to four sizes, 2-inch to 1-inch; 1-inch to ⅝-inch; ⅝-inch to ¼-inch; sand. The oversize is crushed by a 24″ x 13″ jaw crusher. The motors installed vary from 5 h.p. to 35 h.p. The capacity of the plant is 500 cubic yards per day, and fifteen to twenty men are employed, according to demand for the product.*

Photo No. 67. Gravel pit and plant of San Joaquin Rock and Gravel Company, near Friant, Fresno County.

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*Since the above was written, the property has been sold to the Grant Rock and Gravel Company of San Francisco, with offices in Fresno. The washing section of the plant has been enlarged and fully equipped to a capacity of 20 cars (of 40 tons each) per day of 10 hours. Hungarian riffles have been placed in the discharge boxes from the screens to the sand bunkers. Sufficient gold is being recovered in the riffles to pay the operating expenses of this section of the plant.

Sharp & Fellows (see Kings River quarry).

Worswick Street Paving Company (see California Road and Street Improvement Company).

TIN.

Tin ore, occurring with wolframite, is reported by Fred Nobs of Redwood City, in the high Sierran section in eastern Fresno County. The exact locality is not stated.

TUNGSTEN.

L. H. Rhodes and G. E. Brown, of Coalinga, report having made locations on a deposit of tungsten ore in Secs. 29 or 33, T. 18 S., R. 13 E., about 30 miles northwest from Coalinga, near the San Benito County line.

Wm. Terrill of Trimmer has a claim near Trimmer, on a vein carrying scheelite with some gold values. The vein is stated to be 5 feet wide, strike east and west, dip south, with limestone footwall and granite hanging. The scheelite makes in bunches on the hanging-wall side of the vein. It probably would require concentration.

VOLCANIC ASH

Fort Miller Ranch Deposit. McKenzie Estate, owner, Griffith-McKenzie Building, Fresno. On this ranch, 3 miles northeast of Friant, there is a deposit of very fine-grained volcanic ash, 40 to 50 feet thick, over an area of several acres. It occurs in a number of small hills in a basin with a granite rim. Occasional pieces of vesicular pumice are found, but not in sufficient quantity to be of commercial value.

KERN COUNTY.

By G. CHESTER BROWN, FIELD ASSISTANT.

Field Work in September, 1914.

Introduction.

Kern, the leading mineral producing county of California, consisting of 8100 square miles, was organized in April, 1866. It is the third largest county in the State, and is bounded on the north by Tulare, Kings, and Inyo, on the south by Los Angeles and Ventura, on the east by San Bernardino, and on the west by San Luis Obispo. It is characterized by greater variety and contrasts of topography, geology, climate, and resources than any other California county.

This territory embraces the southern end of the San Joaquin Valley, thus affording a large area of land for agricultural purposes.

The wonderful development of the petroleum industry since 1900 has given Kern County first place as a mineral producer.

Topography.

Kern County takes in the southern portion of the Sierra Nevada Range, includes a portion of the Coast Range in its western end, and to the south and east of the Sierras it encloses a large section of the Mojave Desert. The lowest depressions are in its lagoons, where its rivers sink in the plains, some 300 feet above the sea level. It rises from that to 10,000 feet in the high peaks of the Sierra Nevada, its desert region east of the mountains having an elevation of 2751 feet at Mojave, and the mountains to the southwest over 6000 feet. The Sierra Nevada crosses the county from the north; Tehachapi Pass, 3964 feet in height, leading southeasterly; Tejon-Pass, 5285 feet, and Cañada de las Uvas, about the same, leading southerly.

Along the northwestern border is the Diablo Range rising to a height of from 2000 to 3000 feet. From the junction of the Sierra Nevada and the Coast ranges, the San Emigdio mountains project 20 miles northward into the valley.

In the central portion of the southern end of the valley are Kern and Buena Vista lakes, the first covering an area of 13 square miles, and the other 25 square miles, receiving the water of the Kern River through a large number of sloughs, creating an extensive delta of marsh lands. This section has a drainage by Buena Vista Slough to Tulare Lake, 35 miles northwest. By the diversion of the water of Kern River and drainage of the basins, the lakes have become practically dry and much of their former beds are under cultivation.

There are in the county numerous mountain valleys of considerable extent. Poso Flat, Little Poso, and Linn Valley are beautiful parks on Poso Creek, in Greenhorn Mountains, a spur of the Sierra Nevada, west of Kern River. Havilah, once the county seat, and a famous mining town, is in a deep valley of Clear Creek, a branch of Kern, 35 miles northeast of Bakersfield. Tehachapi Valley extends from the summit of the Sierra Nevada at Tehachapi Pass southeast along the valley of Cameron Creek, into the Mojave Desert, having a length of some 8 miles, and from ¼ to 1 mile in width, containing the town of the same name and numerous thrifty farms. Southwest of these are the similar valleys of the Tejon, Las Uvas, San Emigdio, Zapatero, Palita, Castera, and La Siebra.

Streams.

Kern River and Poso Creek are the principal streams of the county, Kern being the third in magnitude of the rivers flowing from the Sierra Nevada south of the Sacramento (see photo No. 1). This river, with a catchment area of 2383 square miles, rises among the highest peaks of the Sierra Nevada, in the northeastern part of Tulare County, having two large forks flowing southwesterly 125 miles. The stream carries an average flow of 805 cubic feet per second, with a flood flow averaging 2000 second feet. This water flows down a granite channel, dropping 8000 feet before entering the valley, and is one of the important streams of the State for the generating of hydroelectric power. It enters the valley near Bakersfield, then flowing westward divides into many channels, forming an extensive delta known as Kern Island.

Thirty large irrigating canals, comprising a total length of over 300 miles, divert water from this river, and serve some 270,000 acres of fertile and productive land.

Poso Creek has its source in many branches high up in the Greenhorn Mountains, the lofty spurs of the Sierra, rising in T. 25 S., R. 30 and 31 E., flowing southerly some 25 miles, then westerly and northwesterly until it sinks in the great valley in T. 25 S., R. 23 E., after a winding course of 75 miles. It has a watershed of 468 square miles.

South of Tulare Lake is a region called the "artesian belt," which is 35 miles long and from 8 to 12 miles wide, running east and west, for the most part in the heart of the plains. About 150 wells supply water for domestic, stock and irrigation purposes. In the Mountain View Colony there is an artesian well which has thrown 450 gallons a minute for twenty years.

Climatic conditions.

Mining operations can be pursued throughout the entire year, as the snowfall, even in the mountainous regions, is not heavy enough to interfere with the work. On the plains the rainfall amounts to about 8 inches per year; the temperature in July or August may reach 110° F., but the absence of humidity makes work not disagreeable.

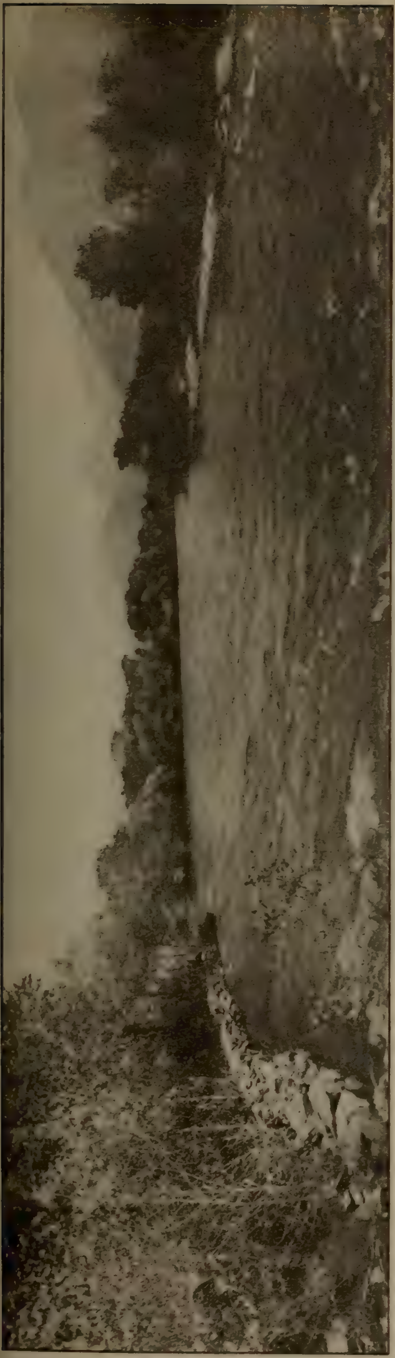

Photo No. 1. Kern River, above Kernville, during flood period.

Photo No. 2. Borel generating plant, Pacific Light and Power Company.

Transportation facilities.

Two great transcontinental railroads, the Southern Pacific and the Santa Fe, pass through the center of the county, in a northerly and southerly direction. From Mojave the Southern Pacific owns and operates the Nevada and California Railroad, reaching Owens River Valley and passing through Nevada to connect with the Southern Pacific, Ogden Route. In the main valley a line of the Southern Pacific runs from Famosa to the east side. The oil fields are reached by branch lines from Bakersfield. Good wagon roads connect the mining districts with the railroads.

Photo No. 3. Canal, Pacific Light and Power Company.

Hydroelectric plants.

Pacific Light and Power Corporation maintains a power station at Borel, on the Kern River, which generates 18,000 horsepower, part of which is distributed for mining purposes in the vicinity of Hot Springs Valley, and the balance transmitted to Los Angeles (see photo No. 2). The company also operates a transmission line at 150,000 volts (the highest in the world) through Kern County, from two plants in Fresno, and maintains a substation at Magunden, 4 miles east of Bakersfield.

The intake for the Borel power plant is at Kernville, below the mill and powerhouse of the Kern Development Company. The canals and tunnels are lined with concrete and have a capacity of 30,000 miner's inches of water (see photo No. 3).

KERN COUNTY—Table of Mineral Production.

Year	Antimony		Asphaltum		Brick		Copper		Fuller's earth		Gold	Lime		Limestone		Silver	Natural gas		Petroleum		Miscellaneous and unapportioned	
	Tons	Value	Tons	Value	Thousands	Value	Pounds	Value	Tons	Value	Value	Barrels	Value	Tons	Value	Value	1,000 cubic feet	Value	Barrels	Value	Kind	Value
1880											$94,214					$390						
1881											190,000					14,000						
1882											260,000					20,000						
1883											150,000					5,000						
1884											100,000					5,000						
1885											72,003											
1886											94,640					1,721						
1887											72,358					150						
1888											60,000					2,500						
1889											242,676					7,517						
1890											117,341					586						
1891											107,735					61						
1892											107,738					73						
1893											83,665					1,754						
1894	92	$3,720	6,900	$138,000							310,707	33,000	$26,500			39,700			11,215	$69,334		
1895	33	1,485	1,400	28,000							231,433	25,400	24,980		$10,000	46,064			116	116		
1896	15	2,250	2,484	44,680							590,867	37,100	32,329	5,000	5,000	34,650			235	235		
1897	25	3,500	4,650	86,350	1,100	$6,600					754,313	53,400	70,370			10,471						
1898	40	1,200	1,850	50,000	2,000	14,000					1,017,930	42,000	29,900			6,543			10,000	10,000	220 tons coal 27 tons borax	$1,100 3,382
1899			2,537	57,670	1,600	11,400			620	$12,400	863,414	64,700	57,690			6,810			15,000	13,500		
1900			701	14,020	2,525	17,300	4,000	$750	500	3,750	805,252	57,721	51,700			147,736			919,275	827,348	Unapportioned, 1900–1909	859,927
1901	50	8,350	3,112	43,126	4,600	23,400	429,248	67,606	1,000	19,500	1,007,059	62,000	82,700			40,497			3,902,125	1,131,616	1,600 pounds lead	64
1902			10,150	101,500	3,500	24,500	235,840	27,122	987	19,246	1,165,982	99,360	80,856			99,135			9,777,948	1,955,585	1,000 tons gypsum	8,000
1903			8,006	100,787	9,000	30,060	4,300	559	250	4,750	1,022,353	101,661	76,246			114,614			18,001,148	3,600,230	28 tons bituminous rock 1,000 tons gypsum	63 8,000
1904			12,451	124,110	700	4,900			500	9,500	1,426,523	178,038	172,000			151,189			19,608,045	3,431,408		
1905			10,586	105,860	750	6,000					1,160,971	279,650	255,500		44,000	134,944			17,069,715	3,174,966	53 tons clay 1,350 tons gypsum 52 tons tungsten	54 11,000 18,800
1906			23,136	231,360	4,275	34,200					806,117	295,613	267,096			129,503			13,826,000	3,765,200	215 tons clay Tungsten	752 183,600
1907			20,443	260,158	2,168	18,428					878,798	175,000	169,822			86,033			15,700,308	4,673,867	1,000 tons gypsum	5,500
1908			50,000	475,000	2,080	19,552					827,087	116,717	87,788			96,550			18,777,871	9,388,935	500 tons gypsum	2,000
1909			54,599	655,391	3,365	29,634			359	5,385	654,799	115,709	88,869			101,633	38,000	$2,714	24,549,758	12,565,246	Gems 1,700 tons gypsum 4,781 pounds lead	500 8,300 174
1910			76,605	811,846	8,332	63,711					619,974	99,187	86,198		4,331	35,041	975,724	47,364	40,641,159	17,825,212	1,675 tons gypsum 160,000 tons rubble	8,305 112,000
1911					5,603	41,426	29,441	3,680			557,471	96,500	82,025	600	400	5,833		165,438	46,562,825	20,207,906	242 tons clay 230,950 tons crushed rock 853 tons gypsum 2,417 pounds lead	121 107,880 4,245 109
1912					1,890	23,120					830,421	162,831	124,894			11,480		325,484	51,448,067	21,762,532	8,479 tons gypsum 19,664 pounds lead	18,188 885
1913					1,625	22,000	3,498	542			649,712	135,000	91,200			11,851	7,111,237	568,899	58,698,432	27,038,474	208 tons clay 10,000 tons gypsum 1,376 pounds lead Other minerals	104 22,750 61 600
Totals	255	$20,505	289,610	$3,327,858	55,113	$390,171	706,327	$100,259	4,216	$74,531	$17,933,553	2,230,587	$1,958,663		$63,731	$1,369,029		$1,109,899	339,519,242	$131,441,710		$1,386,464

Totals.

Antimony	$20,505
Asphaltum	3,327,858
Brick	390,171
Copper	100,259
Fuller's earth	74,531
Gold	17,933,553
Lime	1,958,663
Limestone	63,731
Natural gas	1,109,899
Petroleum	131,441,710
Silver	1,369,029
Unapportioned and miscellaneous	1,386,464
Total to end of 1913	$159,176,373

CAL
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San Joaquin Light and Power Corporation maintains a generating plant at the mouth of the canyon of the Kern River (1350 kilowatts capacity), and a steam plant in Bakersfield (13,500 kilowatts capacity). This corporation distributes power in the Kern River, Midway, McKittrick, and Sunset oil fields for the purpose of pumping oil.

The Bakersfield electric street car system is operated by the San Joaquin Light and Power Corporation.

Southern California Edison Company maintains a generating plant on the Kern River of 30,000 horsepower capacity, and from this plant current is delivered to Los Angeles, 116 miles distant. In the construction of this plant, the canal, which is 8⅔ miles long, consists almost entirely of tunnel, with inside measurements of 8 by 9 feet cut through solid rock to a point above where the powerhouse is located. Another plant on the Kern River, now under construction, will exceed 30,000 horsepower capacity. A railroad survey has been completed o connect with the Southern Pacific Railroad in order that the power equipment may be delivered at this powerhouse by rail. Two addiional power stations are to be constructed at points selected on the Kern River, above Kernville.

Mineral resources.

Kern County's mineral resources consist of antimony, asphalt, barite, borax, brick, cement, clay, copper, fuller's earth, gems, gold, gypsum, ron, lead, lime, limestone, magnesite, marble, mineral paint, natural gas, petroleum, potash, salt, soapstone, soda, silver, stone industry, ulphur, tungsten and molybdenum.

ANTIMONY.

Antimony is found on a spur of the mountain bordering San Emigio Canyon, in Secs. 10 and 15, T. 9 N., R. 21 W., S. B. M., also on Erskine Creek, 4 miles south of Hot Springs, in Sec. 23, T. 27 S., R. 33 E., M. D. M., and 10 miles west of Koehn in Secs. 5 and 6, T. 30 S., R. 36 E., M. D. M.

The San Emigdio and Tom Moore are the only properties that have een worked to any extent. The high cost of transportation and low market value of the product made it impossible to work the ore at a rofit.

Antimony Consolidated Mines, formerly known as Mojave Antimony Company, consisting of 80 acres of patented ground, is located in ecs. 5 and 6, T. 30 S., R. 36 E., M. D. M., about 10 miles west of oehn, and 12 miles northeast from Mojave. Owned by Arthur Asher, 25 S. Los Angeles street, Los Angeles. Ledge is 5 feet wide. Developed by means of shallow shafts and open cuts. Idle for several years.

Rayo, consisting of 40 acres, is located in Sec. 36, T. 26 S., R. 33 E. M. D. M., about 6 miles southeast of Isabella and 37 miles north o Caliente, the nearest railroad station. Ledge from 3 to 10 feet wide developed slightly by shallow shafts and open cuts. Idle for severa years.

San Emigdio, one of the oldest mineral locations in Kern County, i owned by the Kern County Land Company, of Bakersfield. The hold ings consist of 80 acres, patented, in Secs. 9 and 10, T. 9 N., R. 21 W. S. B. M., about 12 miles southwest of Sunset. The ledge is 11 fee wide, strike north and south, dip 68° W., porphyry walls. Working consist of several tunnels from 20 to 600 feet long (caved in a numbe of places). The ore was roasted in an old furnace (dismantled) Some of the ore gave returns of 45 per cent antimony and from $4 t $16 per ton in silver. Property said to have been worked by th padres during missionary period; reopened in 1876 by S. Bouchie Idle for a number of years.

Bibl.: Reports VIII, p. 680; X, p. 225.

Tom Moore, also known as Erskine Creek, consisting of 10 acre patented in 1882, is located in Sec. 24, T. 27 S., R. 33 E., M. D. M about 36 miles north of Caliente in the Valley View mining distric Owned by Orejana Mining Company, of Hayward; C. S. Long, pres dent. Ledge is 3 feet wide, strike north and south, dip 50° E granite-porphyry walls. Workings consist of a number of shaf from 40 to 65 feet deep, and open cuts. Some of the ore carried 65 pe cent antimony and was reduced years ago in an old furnace, now di mantled. Property idle for several years.

Bibl.: Report X, p. 237.

ASBESTOS.

A serpentine belt cutting Jawbone Canyon carries asbestos in tl form of chrysotile, being especially noticeable in Sec. 7, T. 30 R. 36 E., M. D. M.

Sunshine, consisting of three claims located in 1912 by J. H. Durn of Tehachapi, is situated in Sec. 7, T. 30 S., R. 36 E., M. D. about 23 miles north of Mojave by wagon road. Ledge is 10 feet wic strike northeast and southwest, dip 40° S., serpentine walls, a can be traced on the surface for a distance of 150 feet. Prospect, unc veloped.

ASPHALT.

Deposits of natural asphalt are found in the Buena Vista and t Sunset oil districts. In recent years refined asphalt only has been us commercially because a better grade can be produced for less mon than the deposits of natural asphalt afford.

Bibl.: Report XII, pp. 26–28; Bull. 3, pp. 41–53.

BORAX AND POTASH.

The Mojave Desert contains a host of dry lakes and sinks which are he source of many salines, especially borax and potash.

Buckhorn Springs, about 20 miles east of Mojave, in T. 9 N., R. 9 W., . B. M., occupy the south end of a large dry lake, and here are found onsiderable deposits of borates mixed with salt and other salines.

Indian Springs are situated in T. 26 S., R. 38 E., M. D. M., in the est side of the Salt Wells Valley. Borax is present, mixed with salt, oda and other salines. Beds have not been exploited.

Kane Springs, also known as Mesquite, Cane, and Desert Springs, re located in T. 30 S., R. 38 E., M. D. M. Deposit discovered in 1873 y H. J. Lent, who produced some borax of excellent quality here ears ago, but beds have been idle for some time. The rich borate pots cover 3 acres.

Teagle-Churchill Potash Company owns 5792 acres in T. 25 S., R. 40 nd 41 E., known as China Borax Lake and Salt Wells Lake, which ere located in 1911. This company consists of E. E. Teagle, C. H. hurchill, and associates. It is proposed to drill and pump the deposit r treatment to produce borax and potash. Searles Lake is 2 miles st.

Bibl.: Bull. 24, p. 50. The Saline Deposits of California, issued by State Mining Bureau.

BRICK AND CLAY.

The clay deposits in the vicinity of Bakersfield, the county seat of ern County, furnish excellent material for the manufacture of brick.

An unusually good grade of pottery clay is obtained from a large posit in Sec. 11, T. 9 N., R. 13 W., S. B. M., about 5 miles north-est of Rosamond Station, which has been worked by the Los Angeles ottery Company.

Bakersfield Sandstone Brick Company own a clay deposit consisting 10 acres (patented) in Sec. 28, T. 29 S., R. 23 E., M. D. M., in ast Bakersfield. Home office is Bakersfield. W. S. Tevis, president; s. Curran, manager. The plant consists of Kommick-Elbring inder, kilns of a daily capacity of 40,000 brick, cars for holding brick en drying, buildings, etc. Two classes of brick are manufactured: ndstone selling for $15 per 1000 for red, $13 for select and $9 for sec-d grade; clay brick sells for $9 per 1000. Twenty-five men are ployed. Some clay is purchased from the East Side Canal Com-ny. Oil is used for fuel.

Kern County Brick Company's holdings consist of 12 acres, patented, in Sec. 21, T. 29 S., R. 28 E., M. D. M., in East Bakersfield. O. V. Paye, of Bakersfield, controls this corporation. The deposit is 25 feet thick and has been worked for twenty years. The plant consists of Potts disintegrator, kilns, buildings, etc. Capacity of plant is 37,000 brick per day, which sell for $8 per 1000 at the yard; cost of manufacturing about $4 per 1000. Ten men employed. Oil used for fuel, costing 40 cents per barrel.

Los Angeles Pottery Company, also known as the Hamilton deposit, owns 40 acres in Sec. 11, T. 9 N., R. 13 W., S. B. M., some 5 miles northwest of Rosamond Station. The deposit covers about 5 acres, the clay being plastic, has a smooth, even texture, shows no evidence of stratification, and is about 25 feet thick. It varies in color from greenish to light gray, and has been used for the manufacture of pottery and firebrick. Material has been shipped to the company's plant at Los Angeles. Workings consist of a tunnel 200 feet long, and a pit about 45 feet deep. Idle for several years.

Bibl.: State Mining Bureau Bull. No. 38, p. 212.

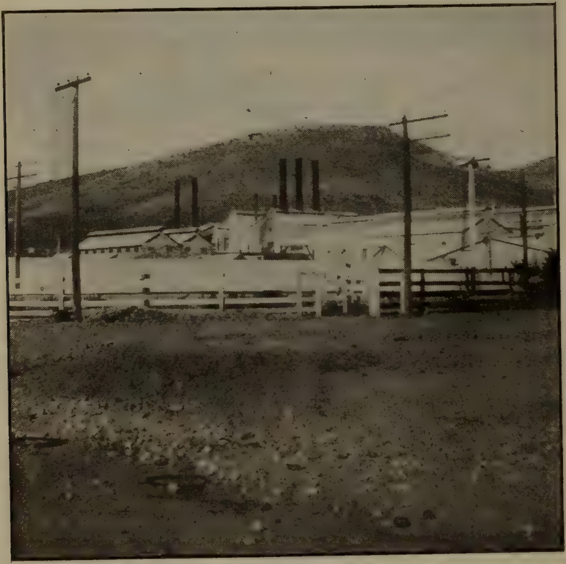

Photo No. 4. Cement plant at Monolith, erected by City of Los Angeles.

CEMENT.

Los Angeles Aqueduct Plant was constructed by the city of L Angeles to manufacture cement for use in constructing the Owens Riv water supply system. The holdings, consisting of 120 acres, are locat in Sec. 14, T. 32 S., R. 33 E., M. D. M., at Monolith Station, 3 mil east of the town of Tehachapi (see photo No. 4).

Limestone was obtained near the plant, and also from the Summit quarry. An ample supply of clay was extracted from a pit near the works. The plant has a daily capacity of 1250 tons, operated by electricity from Pacific Light and Power Corporation.

COAL.

Small seams of coal 18 inches wide, in the vicinity of Garlock, T. 28 S., R. 38 E., M. D. M., were worked some years ago by the Randsburg Coal Company. Three shafts, 80, 145 and 150 feet in depth, were sunk on the vein.

COPPER.

The copper occurrences are so few and widely separated, as far as discovered, that they can not be identified with any particular belt. Copper deposits exist in three localities: Near Woody, north of Randsburg; on the northern edge of the Mojave Desert; and on the southeastern slope of the Sierras, in Secs. 7, 18, 19 and 30, T. 28 S., R. 40 E., M. D. M., and in Secs. 12, 13 and 24, T. 28 S., R. 39 E.

The road from Randsburg to the south fork of the Kern River, through Walker's Pass, diagonally crosses copper croppings in T. 27 S., R. 38 and 39 E., M. D. M.

The country rock in the Keyes mining district in Secs. 29 and 31, T. 26 and 27 S., R. 33 E., M. D. M., is impregnated with copper carbonates, and a small amount of development work has been done in this territory in prospecting for gold. Greenback is the only producing copper mine in the county.

Copper King, consisting of 40 acres, is located in Sec. 3, T. 27 S., R. 33 E., M. D. M., in the Keyes mining district, about 6 miles southwest of Isabella, in the Sequoia National Forest Reserve. Owner, G. C. Hooper. Elevation 5500 feet; vein matter, consisting of country rock with copper carbonates, about 10 feet wide, strike northwest and southeast, dip 30° N.; slate footwall and granite hanging. Slightly developed with a tunnel 230 feet in length. A little high grade ore found, carrying gold values. Prospect.

Greenback Group, the largest copper mine in Kern County, is located n Secs. 1, 2, 3, 4, and 10, T. 26 S., R. 29 E., in the town of Woody and 32 miles northeast of Bakersfield. The holdings, consisting of 2300 acres (600 patented), are owned by I. Weringer, of Woody. Elevation 800 feet; discovered in the early fifties, and surface worked for gold values. Located in 1890 by present owner. Six parallel veins about 00 feet apart; average width 30 feet; strike northeast and southwest, dip 60° N.; granite walls. On the Iron Mountain Chief the croppings are pronounced. Workings consist of a single-compartment shaft 200 feet deep, sunk at 45° angle, three levels at 100′, 140′ and 200′; 360 feet of drifts; 100 feet raise. The equipment consists of horse whim, ore bin, cars, tools and assay office. Two men employed. Ore recently shipped to smelter was hauled in motor trucks to MacFarland, a distance of 25 miles, at a cost of $5 per ton. Property produced to date $40,000; about 4000 tons of ore on dump and considerable in sight in mine. Sulphide at 60-foot depth, runs from 5% to 30% copper and $2 per ton in gold. Iron Mountain Wonder adjoins Greenback on the south.

Bibl.: Bull. 50, p. 297, issued by State Mining Bureau.

Iron Mountain Wonder consists of 20 acres in Sec. 10, T. 26 S., R. 29 E., about ¼ mile east of Woody. Owners, Hancock and Sorenson, of Woody. Two parallel veins about 20 feet wide, strike northeast and southwest; dip 60° N.; granite walls. Slightly developed with 60-foot shaft and 80-foot tunnel; continuation of Greenback lode. Prospect. Idle.

Silverado Mountains, consisting of 40 acres, is located in Sec. 29, T. 26 S., R. 33 E., in the Keyes mining district, 1 mile south of Isabella, in Sequoia Forest Reserve. Owner, C. L. Warfield. Elevation 3500 feet. Fissure vein, 3 feet wide, consisting of greenish colored quartz, carrying copper carbonates and gold; strike northwest and southeast, dip 60° SW. Developed with two tunnels on vein, 210 and 620 feet in length. Worked for a time by lessees, who took out some rich ore from pockets. Prospect. Idle.

FULLER'S EARTH.

Fuller's earth is a soft, friable clay, that is used in fulling wool, in deodorizing and clarifying oils, fats, greases, and in the production o clay pigments as a basis for color printing on wall papers. It falls to powder readily in water, and removes with avidity grease from cloth. The shades of color of fuller's earth are fully as great as those of other kinds of clay. Most of the earths on the market are ligh brown, gray, buff, or cream color, and a few are almost white. Al which have been found valuable for bleaching purposes show a distinc acid reaction. Fuller's earth, as a rule, is lighter and more porous tha other clays. The market value ranges from $10 to $15 per ton.

California Fuller's Earth Company. Packard Estate, Bakersfield owners, control 140 acres (patented) in Sec. 14, T. 27 S., R. 28 E M. D. M., about 18 miles north of Bakersfield. This deposit cover many acres and varies in thickness from 15 to 50 feet. A thin laye of soil covers this earth, which is first removed and then the materia is taken out in open pits. Deposit was first worked in 1898 b

H. L. Packard, and the material hauled to Bakersfield, ground, and shipped to Kansas City, Mo., for refining animal and vegetable oils. Property has not been worked for several years.

The analysis of the earth shows:

Silica (SiO_2)	54.32%
Alumina (Al_2O_3)	18.88%
Iron oxide (Fe_2O_3)	6.50%
Lime (CaO)	1.00%
Magnesia (MgO	3.22%
Loss on ignition	11.86%
Alkalies (by difference)	4.21%

Bibl.: Bull. 38, p. 275, issued by California State Mining Bureau.

The Eight Oil Company, with a small grinding plant at Bakersfield, has reported production of fuller's earth from Kern County.

GOLD.

The first discovery of gold in Kern County was made by a member of Fremont's party in 1851, at Greenhorn Gulch, near the Kern River. Here a camp soon sprang up, and it is claimed that some of the placer ground yielded $50 to the pan. This territory was known in the early days as Whiskey Flat.

Jonathan and Keyes, shortly after the Whiskey Flat excitement, made the first quartz discovery in Rich Gulch, near the site of the old town of Keyesville. The first mine was named the Brother Jonathan, an arrastra was built, and as the ore ran over $100 per ton they made money. The Mammoth mine near by, was located after the Brother Jonathan discovery, and Captain Maltby, the owner, erected a costly water power mill, which was a failure, as the mortars leaked out the quicksilver that was recklessly thrown in. Colonel Keyes erected the first practical wooden stem, hog trough, iron mortar mill, consisting of four stamps. The cost of mining and milling was $15 per ton and, as the ore ran over $100 per ton, a handsome profit was made.

In 1861 Rogers and Olds discovered the mines of the Cove district, near Kernville, which have produced several millions, and which were extensively worked for over twenty-five years.

The discovery and working of the mines of the Cove district were a great incentive to prospecting, and resulted in the finding of the Clear Creek quartz mines by Ben Mitchell. The town of Havilah was built, and at one time was the county seat of Kern County.

The discovery of placer gold at Goler, in 1893, led to the development of quartz mines in this section, as the Yellow Aster find soon followed, which caused the Rand to be the largest producing district in the county.

Mining districts.

Amalie, also known as the Agua Caliente mining district, is the name used to designate the territory between the most southerly summits of Pah Ute range and Caliente Creek.

The characteristic geological features of the district consist of syenite and slate formations traversed by numerous trachytic dikes. The altitude ranges from 2500 feet on Caliente Creek to 7000 feet in the Pah Ute range.

A good wagon road connects this district with Caliente, a town on the Tehachapi branch of the Southern Pacific Railroad. Amalie, a small settlement in the center of the district, is 15 miles east of Caliente.

Clear Creek, 25 miles north of Caliente, by wagon road, includes the territory in T. 28 S., R. 32 E., M. D. M. The formations consist of syenite and slates, cut by numerous diorite dikes. The altitude ranges from 3000 to 5500 feet. Havilah, a small settlement on Clear Creek, is the post office.

Cove, one of the famous mining districts in the county, is 42 miles north of Caliente, by wagon road (see photo No. 5). The natural amphitheater occupied by this territory is the characteristic which gives it its name. The formations consist of granite and slate, the former predominating. Nine lodes can be traced on the surface for a considerable distance, as the croppings are very bold. The value of the main lode (Sumner) lies in its great size and the vast amount of good milling rock which it can furnish; it is over 150 feet wide in places. The Nellie Dent and Commonwealth lodes are also of unusual width, carrying low grade gold values. The installation of large reduction plants will make this district one of the best producers in Kern County, as an abundance of water from the Kern River for power purposes, topography suitable for open-cut mining, and ideal climatic conditions afford very cheap mining and milling costs. The altitude ranges from 2600 to 5000 feet.

Green Horn Mountain District includes the territory adjacent to the Green Horn Mountains, about 48 miles north of Caliente, by wagon road, in T. 26 and 27 S., R. 31 and 32 E. This region adjoins the Keyes mining district on the west. The formations consist of granite and slate A limited amount of placer mining is pursued in this section. The altitude ranges from 3000 to 6500 feet.

Green Mountain District includes the territory from Piute post office to Kelsey Valley on the east dip of Piute Mountain, T. 28 and 29 S. R. 34 E. Piute post office is 30 miles northeast of Caliente by wagon road. The formations consist of slate and schists, cut by diorite dikes The veins, as a rule, are small but rich; the ore shoots are short. Pocket mining is pursued mainly in this district. The altitude ranges from 3500 to 8000 feet.

Keyes, the oldest mining district in Kern County, includes the territory north and west of the old site of Keyesville for a distance of about 5 miles, in T. 26 S., R. 32 and 33 E. Isabella, the post office, is 37 miles north of Caliente, by wagon road. Granite is the predominating formation. The veins are narrow, but carry good values in gold. The Keyes quartz mine has been worked intermittently for sixty-two years. Placer mining was extensively pursued here during the fifties.

Long Tom District, 20 miles northeast of Bakersfield, in T. 27 S., R. 29 E., M. D. M., is known chiefly on account of the Long Tom mine, which was a famous producer several years ago. The formations consist of diabase and granite. A good wagon road affords an easy means of transportation between this district and Bakersfield, the county seat. The altitude ranges from 1500 to 2500 feet.

Mojave District includes the territory in T. 10 and 11 N., R. 11, 12, and 13 W., S. B. M. The principal mines are only 3 miles south of Mojave, a town on the junction of the Santa Fe and Southern Pacific railroads. The formations consist of quartz-porphyry, phonolite and granite. The veins are large, with lenses of high grade, so that practically all of the ore can be profitably worked with adequate reduction plants. The lack of timber is no handicap as the ground stands well. The climatic conditions are good, being similar to other sections of the Mojave Desert.

The Pioneer District includes the territory in an easterly and westerly direction between Greenhorn Mountains and the Green Mountain mining district, and in a northerly and southerly direction from Clear Creek to Erskine Creek, in T. 27 and 28 S., R. 32 and 33 E., M. D. M. The formations consist of granite, porphyry, slate, and syenite. Bodfish, the post office, is 32 miles north of Caliente by wagon road. Mining operations can be pursued throughout the year. Wood and water are abundant. The altitude ranges from 3000 to 8000 feet.

Rand Mining District comprises the territory in T. 29 and 30 S., R. 40 E., M. D. M., Kern County, and T. 29 and 30 S., R. 41 E., M. D. M., San Bernardino County. The formations consist of granite, andesites, basalt, schists, sandstone, limestone and quartzite. The rocks of Rand Mountain are schists, with quartzite and altered limestones. The fragmental deposits, such as sand and gravel, cover considerable areas, but only a small portion are of economic importance.

Gold was first discovered in the Goler Wash, 9 miles northwest of Randsburg in 1893, and dry washing camps soon sprang up in Last Chance and Red Rock canyons, and at Summit Diggings. In 1895 the Yellow Aster mine was discovered by Singleton, Burcham & Mooers, and other quartz discoveries quickly followed. A railroad was

Photo No. 5. Cove Mining District, looking north.

Photo No. 6. Amalie mine, mill and hoist.

soon constructed from Kramer, on the Atchison, Topeka and Santa Fe Railroad, to Johannesburg. A number of mines, after taking out fair ores near the surface, were unable to follow them downward owing to faulting, pinching of the vein, or impoverishment of the ores and have been abandoned. Mines, including placers, have produced $10,000,000, of which the Yellow Aster has taken out $6,000,000.

In the old Stringer District, so named on account of narrowness of the veins, some rich ore has been worked. This section is located along the southeast side of Rand Mountains, from 1½ to 4 miles southwest of Randsburg. The Napoleon is said to have yielded $1,000 per foot from a shaft 100 feet deep. The veins in this district are all more or less disturbed by faults, having a maximum width of 2 feet (U. S. Geol. Surv., Bull. No. 430). The altitude ranges from 3500 to 5000 feet.

The Red Dog custom mill, about ¼ mile southwest of Johannesburg, handles ores from the Rand district. This plant is owned by Stanford Mining and Reduction Company, of Los Angeles, and consists of ten stamps, cyanide plant, and one Standard concentrator, operated by steam and electricity.

Tehachapi District includes the territory in T. 32 S., R. 33 and 34 E., M. D. M., and T. 11 N., R. 14 and 15 W., S. B. M. The formations consist of granite, quartz-porphyry, limestone and basalt. The Pine Tree is the only gold mine with any production record. The mining industry at the present time is confined to the extraction of limestone. The altitude ranges from 3900 to 6000 feet.

Woody, formerly White River mining district, includes the territory in T. 25 and 26 S., R. 29 and 30 E., M. D. M. Woody, the post office, is 31 miles northeast of Bakersfield, by wagon road. The formations consist of granite, quartz-porphyry and slate. The veins, as a rule, are narrow and have been disturbed by faults. Mining has been confined to shallow workings. Rich ore has been found on the surface, and as a result this district was very active some eighteen years ago Placer mining was extensively pursued near Woody during the '50s. The altitude ranges from 1800 to 3000 feet.

Valley View District includes a portion of the territory in T. 27 and 28 S., R. 33 and 34 E., M. D. M., along Clear and Erskine creeks, about 35 miles north of Caliente. The formations consist of granite, syenite and slate, cut by numerous diorite dikes. The veins are from 2 to 8 feet in width, carrying good milling values. An ample supply of wood and water is at hand. The mineral resources of this district are still undeveloped. The altitude ranges from 3500 to 7500 feet.

Mines and prospects.

Accident, consisting of 40 acres, is located in Sec. 32, T. 11 N., R. 12 W., S. B. M., about 3 miles south of Mojave, in the Mojave mining district. It is a prospect slightly developed by short tunnels on the vein. Owner, G. E. Ashler.

Amalie, one of the famous old producers of this county, is located in Sec. 22, T. 30 S., R. 33 E., M. D. M., about 18 miles northeast of Caliente, in the Amalie mining district (see photo No. 6). The holdings consist of 180 acres in the Sequoia National Forest Reserve, owned by the Provident Mining Company; T. Bowden, president; B. W. Marks, secretary; home office, Union Trust building, Los Angeles. The vein is narrow, averaging about 10 inches in width, but rich; strike NW. and SE., dip 40° E., quartz-porphyry walls. Pay shoot is about 180 feet long and 10 inches wide, free milling. Ore carries considerable silver below the surface oxides, rich on the surface in free gold. Workings consist of a vertical shaft 560 feet deep, five levels, raises, stopes and drifts, comprising over 5000 feet of work. Mine equipment consists of cars, 60 h.p. boiler, steam hoist, five dwellings and assay office. Reduction equipment consists of 5-foot Huntington mill, driven by both gasoline and steam, three concentrators and 50-ton cyanide plant, leased to Barbarossa Mining Company. Property said to have produced $600,000. Idle since 1912. Barbarossa mine adjoins the Amalie on the north.

Bibl.: Reports XII, p. 141; XIII, p. 605.

American Golden Eagle, owned by Homer Bros., of Havilah, consists of 100 acres, in Secs. 2 and 10, T. 28 S., R. 32 E., M. D. M., in the Clear Creek mining district, 2 miles south of Havilah, in the Sequoia Forest Reserve. Claims formerly owned by American Golden Eagle Mining and Milling Company, of Los Angeles, who worked property for several years, then abandoned it. Relocated by Homer Brothers. Ore free on surface, but base with depth, carrying gold, silver and copper. Vein 8 feet wide with quartz-porphyry walls, strike northeast and southwest, dip 85° E. Workings consist of 100-foot shaft, 200-foot tunnel, drifts and stopes. Small producer. Ore shipped to smelter. Claims worked by owners. Adjoins McKidney prospect on the west.

Anatrosa is a prospect located in Sec. 13, T. 30 S., R. 32 E., M. D. M., 8 miles east of Caliente, in Amalie mining district, and in the Sequoia National Forest. Owned by Blodget et al., of Bakersfield. Leased to H. Williams. Vein is 30 feet wide, low grade. Small vein of high grade ore recently found in granite. Slightly developed with 200-foot tunnel and open cuts.

Arizona Group, consisting of 80 acres, is a small producer in the Rand mining district, 5 miles south of Randsburg, owned by Henry Bopp. Located in January, 1913. Small vein in schist. Sinking a shaft, at present 60 feet deep; gasoline hoist (8 h.p.) is used. Ore hauled to Red Dog custom mill. Twenty tons gave returns of $1520. Two men employed.

Baltic, a producer, in the Rand district, is located in Sec. 1, T. 20 S., R. 40 E., M. D. M., 1½ miles southeast of Johannesburg. Holdings consist of 40 acres (patented), owned by the Baltic Mining Company, of Randsburg; C. H. Wynn, president; H. R. Wynn, secretary and manager. Deposit consists of many small veins in a sheer zone of schistose quartz from 100 to 300 feet wide. Country rock is rhyolite and porphyry. Ore is free milling. Workings consist of two incline shafts, each 250 feet deep, levels, stopes, and 150 feet crosscut. Steam hoist is 20 h.p. Owners claim an ore reserve of 200,000 tons, assaying $2.50 per ton. Reduction equipment consists of 10-stamp Llewellyn mill, Blaker crusher (8″ x 10″), and 50-ton cyanide plant. Electric power used. Twenty men are employed. Adjoining mines are: G. B. on north, Gold Coin on south, Placer Gold Company on east and Bismarck on west.

Barbarossa Group, the largest producer in the Amalie mining district, is located in Sec. 29, T. 30 S., R. 33 E., M. D. M., about 15 miles northeast of Caliente, in the Sequoia Forest Reserve. This group, consisting of 140 acres, is owned by B. G. Parlow, of Loraine. Elevation at lower tunnel is 3600 feet. There are seven veins on the claim; only one however, the Barbarossa, has been worked. Strike of this vein is northwest and southeast, dip 40° E., average width 4 feet; granite footwall and quartz-porphyry hanging. Pay shoot is 200 feet long and 4 feet wide, free milling. Workings consist of several tunnels on the vein, drifts and stopes. Ore is hauled in wagons to Amalie mill, a distance of 1½ miles. Five men are employed. Property produced $4000 in June, 1914; total production, $60,000. Croppings on Gasonia claim are 1000 feet long and 40 feet wide, and carry some gold values. Pacific Light and Power Company's line runs through these claims.

Beauregard, one of the famous mines of the Cove district, is located in Sec. 28, T. 25 S., R. 33 E., M. D. M., in the Sequoia Forest Reserve, and ¾ of a mile north of Kernville. Elevation 3000 feet. This property consists of one claim (1200 feet long and 200 feet wide), making a total area of 6 acres, patented in 1882, and is owned by the Kern Development Company. C. S. Long, president; C. C. Hamilton, secretary; home office, Portland, Me.; local office, Kernville. Located in 1861, and acquired by present owners in 1907. There are two parallel veins on the claim, averaging 3 feet in width, strike S.

75° W., dip vertical; granite walls. Pay shoot is 1200 feet long and 3 feet wide, and has been worked for this distance. Workings consist of seven shafts from 100 to 300 feet deep, three levels, 2300 feet of drifts, and six stopes. Ore treated in 10-stamp mill, operated by water power from Kern River. Ditch is 2¼ miles long. Production to date, $600,000. Worked at one time by leasers. Ore is very free and plates $35 per ton. Some high grade found at times. Adjoining mines: Minnie E. on north and west, Urbana on south and North Extension Sumner on east.

Bella Rufin, formerly known as the Berry, is located in Sec. 25, T. 29 S. R. 33 E., M. D. M., in the Green Mountain district, about 23 miles northwest of Caliente. Elevation 3000 feet. Holdings consist of 40 acres, in Sequoia Forest Reserve, at an elevation of 3000 feet. Owned by J. E. Miller; leased to E. Peterson, Piute post office. Vein is 4 feet wide, strike southeast and northwest, dip vertical; granite walls. Pay ore occurs in pockets. Workings consist of shaft 120 feet deep, short drifts and one stope. Old 12-foot steam arrastra, horse-whim and cabin on property. Small producer. Total production about $15,000. Prospect. Mentioned in Report XII, p. 142.

Photo No. 7. Flashlight photo, showing ore in Big Blue Mine, 240-foot level.

Big Blue, owned by the Kern Development Company. C. S. Long, president and manager. Was one of California's famous gold producers in the '70s (see photo No. 7). The holdings, consisting of 12 acres patented in 1872, are located in Sec. 28, T. 25 S., R. 33 E.,

M. D. M., in the Cove mining district, about ½ mile north of Kernville, in the Sequoia Forest Reserve. Elevation 2900 feet. Three parallel veins known as East, West and Middle, which have an average width of 44 feet, strike N. 20° W., and dip 70° W. West vein pay shoot is 1500 feet long and 44 feet wide. Workings consist of four shafts, designated as Pierson, Engine, Donkey and Adit, maximum depth being 400 feet, five levels, over a mile of drifts, several stopes, three tunnels, the adit having a length of 2100 feet, and drains the Big Blue at a depth of 270 feet, another the Blue Gouge is 1057 feet long. Mine equipment consists of hoist, shops and office. Ore is reduced in 10-stamp mill on Kern River. Two men working at present. Property has produced $2,000,000. Some of the ore runs over $300 per ton in free gold. Adjoining mines: Sumner on north, Oriana and Blue Gouge No. 2 on west, Content on south, Juniper on east.

Bibl.: Reports VIII, p. 315; XIII, p. 191.; U. S. Comm. of Mineral Statistics, Raymond, 1875.

Black Hawk Group, consists of 130 acres, in the Rand district, 2½ miles southwest of Johannesburg. Owner, D. A. Blue, of Randsburg. Three veins, designated as South, North and Gray Eagle. Workings consist of four shafts, from 70 to 130 feet deep, and 4000 feet of drifts. Country rock is schist. Mine equipment consists of two horse-whims, blacksmith shop and cabins. A 5-stamp mill on Black Hawk claim constitutes the reduction equipment. Water obtained from Randsburg Water Company, through 3 miles of 1-inch pipe. Three men employed. Placer deposits on Gray Eagle, One and Two Track claims, which owner states runs $6 per ton in free gold and $2.50 in tungsten. Small producer.

Blue Gouge Group, consisting of 350 acres, is located in Secs. 28 and 33, T. 25 S., R. 33 E., M. D. M., in the Cove mining district, 2 miles north of Kernville in the Sequoia Forest Reserve. Elevation 3600 feet. Owners, Orejana Mining Company; C. S. Long, president and manager; C. C. Hamilton, secretary; home office, Hayward. Eight parallel veins on the claims, average width 5 feet (small veins), strike northwest and southeast, dip 68° N.; granite walls. The large lode (east vein) is from 100 to 500 feet wide, low grade. Workings consist of crosscut tunnel 1057 feet long, shaft 200 feet deep, one stope, and several open cuts. High grade ore on the S. F. Belle, from which 75,000 in gold has been extracted. The Red Top, Blue Gouge, and Lynx claims contact with the Content and Nellie Dent ore bodies, forming a width of 500 feet of low-grade ore that can be worked as an open cut. This, owing to its abrupt elevation and being only 2000 feet from the Kern River, could be handled by gravity to a mill conveniently located so as to take advantage of the cheap power which is abundant.

Bright Star, a noted mine of the Green Mountain district, located in Sec. 10, T. 28 S., R. 34 E., M. D. M., 34 miles northeast of Caliente, in Sequoia Forest Reserve, is owned by Mrs. Tracy et al., of San Francisco. Elevation at shaft 8400 feet. Holdings consist of 60 acres, patented, located some forty-five years ago. The vein has an average width of 20 inches, strike northeast and southwest, dip 60° N., slate walls. Pay shoot about 120 feet long and 20 inches wide, high grade ore. Workings consist of a shaft 540 feet deep, three levels, several thousand feet of drifts and stopes. The ore was treated in a 5-foot Huntington and 3-stamp mills, now removed from property. The Denver Gold and Silver Extraction Company worked the tailings with a 50-ton cyanide plant with good results. Production record said to be $600,000. Idle for several years. Collar Button, a prospect, adjoins property on west.

Bright Star, a prospect in the Woody mining district, was a small producer a few years ago. It is in Sec. 12, T. 25 S, R. 29 E., M. D. M., about 41 miles northeast of Bakersfield. Owner, E. A. James. Two parallel veins, having a width of 2 feet, strike E. and W., dip 30° S.; short pay shoot. Workings consist of tunnel on vein 600 feet long, and 800 feet of drifts. Idle.

Bull Run, another famous producer of the Cove mining district, consisting of 5.67 acres, patented in 1884, is located in Sec. 28, T. 25 S., R. 33 E., M. D. M., about ½ mile north of Kernville in the Sequoia Forest Reserve. Elevation 2980 feet. Owners, Lady Belle Company; Dr. R. P. Schupphaus, president; C. C. Hamilton, secretary; home office, Portland, Maine; local office, Kernville. Vein is 2 feet wide, strike northeast and southwest, dip 70° N. Pay shoot is 900 feet long and 2 feet wide, free milling, rich sulphurets. Workings consist of main shaft 360 feet deep, seven levels, several thousand feet of drifts and crosscuts, and one stope 900 feet long. Mine equipment consists of hoisting plant, shop and office. Production to date $450,000. In 1893 J. B. Medina, a former lessee, mined from the north end of this property (at a depth of 80 feet), 100 tons of ore that gave returns of $150 per ton on the plates and $400 per ton from the concentrates.

Bibl.: Report VIII, p. 321.

Caldwell, a prospect, is located in Sec. 18, T. 26 S., R. 33 E., M. D. M., in the Keyes district, about 1½ miles northeast of Isabella, in the Sequoia Forest Reserve, comprising 20 acres, owned by A. R. Kiester. Vein is 6 inches wide, high grade ore. Workings consist of tunnel on vein 620 feet long, and short drifts. Formation is granite and slate.

Chief, prospect, in the Long Tom district, in Sec. 22, T. 27 S. R. 29 E., M. D. M., about 21 miles northeast of Bakersfield, owned by D. M. Tressel. Consists of 60 acres, elevation 2100 feet. Small vein in granite. Workings consist of two tunnels on vein, being 120 and 380 feet in length, and short drifts. A little high grade ore extracted by leasers.

Collar Button, prospect, is located in Sec. 10, T. 28 S., R. 34 E., M. D. M., in the Green Mountain district, about 34 miles northeast of Caliente, in the Sequoia Forest Reserve. Elevation 8100 feet. Owner, W. B. Grant, of Piute post office. Holdings consist of 14 acres. Vein is 2 feet wide, in slate. Extent of pay shoot not determined. Shaft 60 feet deep, shows 2 feet of ore that runs $40 per ton. Bright Star adjoins claim on east.

Commonwealth, owned by the Kern Development Company. C. S. Long, president and manager. Consists of 32.4 acres, patented, in Sec. 15, T. 25 S., R. 33 E., M. D. M., in the Cove district, about ½ mile north of Kernville in the Sequoia Forest Reserve; elevation 3000 feet. Four parallel veins in slate and granite, average width 4 feet. Only slightly developed with shallow shaft and open cuts. Surface ore mills $15 per ton.

Crystal, formerly known as the Bonanza, is a prospect in the Clear Creek district, in Sec. 2, T. 29 S., R. 31 E., M. D. M., about 22 miles north of Caliente in the Sequoia Forest Reserve. Holdings consist of 0 acres, owned by A. R. Cox. Elevation 2500 feet. Vein is 10 inches wide, in granite. Slightly developed with 120-foot shaft. Small pocket aken out in May, 1914.

Dead River Channel (placer), consists of 40 acres of placer ground n Sec. 17, T. 26 S., R. 33 E., M. D. M., in the Keyes mining district, bout 1½ miles north of Isabella, at an elevation of 2500 feet. Owner, C. E. Barton. Course of channel is north and south, depth of gravel 0 feet. Granite bedrock. Water obtained from Kern River. Small producer.

Deer Hunter, is a prospect in the Amalie district, Sec. 20, T. 30 S., R. 34 E., M. D. M., about 18 miles northeast of Caliente, in the Sequoia Forest Reserve, at an elevation of 4100 feet. Owner, M. D. Elliott. Holdings consist of 60 acres. Small vein, in granite and schist. Slightly developed with short tunnel and drifts. Little high grade xtracted.

Double Standard, owned by the Mojave Mining and Milling Comany, of Los Angeles; G. E. Benton, president; B. Wagemann, watchman. Consists of 40 acres in Sec. 5, T. 10 N., R. 12 W., S. B. M., in the Mojave district, 3 miles south of Mojave. Elevation 2700 feet. Vein is 5 feet wide, strike northeast and southwest, dip 40° W quartz-porphyry walls, ore free milling. Workings consist of shaft

200 feet deep, two levels, and 2000 feet of drifts and stopes. Mine equipment consists of steam hoist, cars, tools, assay office, dwellings. Reduction equipment consists of 5-stamp mill (1100-pound stamps), operated by steam power. Idle. Two men employed. Property has been a producer.

Dreadnot, formerly known as Hardtack, consists of 80 acres in Secs. 11, 12 and 14, T. 25 S., R. 29 E., M. D. M., about 40 miles northeast of Bakersfield in the Woody mining district. Owners, Blue Mountain Mining Company, of San Jose; E. Wolf, president. Two parallel veins known as Dreadnot and Grizzly, strike east and west, dip 45° N., width 2 feet, free milling. Workings consist of a shaft 220 feet deep, three levels, 400 feet of drifts and one stope. Mine equipment consists of steam hoist, cars, tools and dwellings. Reduction equipment consists of 5-stamp mill and two Frue concentrators. Property is idle.

Bibl.: Report XII, p. 143.

Early Sunrise, a prospect, owned by the Early Sunrise Mining and Milling Company, of Santa Ana; W. W. Holesworth, president; W. A. Penrol, secretary. Consists of 60 acres, in Sec. 26, T. 26 S., R. 32 E., M. D. M., in the Keyes district, about 3 miles south of Isabella, in Sequoia Forest Reserve. Elevation 3600 feet. Small vein, in granite. Slightly developed with short tunnel, 430 feet long, and a few hundred feet of drifts. A little high grade found. Idle.

Eclipse No. 1, a prospect in the Woody mining district. Owned by D. Engle et al., is located in Sec. 34, T. 25 S., R. 29 E., M. D. M., ½ mile north of Woody. Elevation 2000 feet. Holdings consist of 20 acres. Vein is 1 foot wide, granite walls, ore free milling on the surface, but base with depth. Slightly developed with shaft 70 feet deep and a tunnel 80 feet long, and short drifts. Ore was worked in a Huntington mill (now removed), and gave returns of $40 per ton on plates. Said to have produced $20,000. Idle.

Elephant Group, consists of 100 acres, in the Mojave mining district, in Sec. 6, T. 10 N., R. 12 W., S. B. M., about 5 miles south of Mojave, at an elevation of 3900 feet. Owner, D. E. Baker, of Nordhoff; B. Fisher, superintendent. The vein is 7 feet wide, 3 feet in bottom of shaft, said to run $200 per ton in gold, strike northwest and southeast, dip 60° N., granite-porphyry walls. Workings consist of a shaft 100 feet deep, short drifts, and one stope 120 feet long. Mine equipment consists of windlass, cars, tools, shop and cabin. Three men employed. Ore shipped to Selby's smelter, total cost (smelter charges, freight, mining, etc.) is $10 per ton for ore assaying $50 per ton. Small producer.

Ella Group, a prospect located in May, 1914, in the Amalie mining district, in Sec. 29, T. 30 S., R. 33 E., M. D. M., 15 miles northeast of Caliente, is owned by Rainey Brothers of Loraine. Group consists of 40 acres. Elevation 4000 feet. Vein 2 feet wide, runs $40 per ton in free gold, granite footwall and rhyolite hanging. Slightly developed with shaft 55 feet deep and a short drift. Three owners working. Forty tons of ore on dump.

Ellston, formerly known as Producer, is a prospect, in the Clear Creek mining district, in Sec. 8, T. 29 S., R. 31 E., M. D. M., 20 miles north of Caliente, in the Sequoia Forest Reserve. Owner, R. E. Ellston. Holdings consist of 55 acres, at an elevation of 3200 feet. Pay ore occurs in pockets in granite. Slightly developed with shaft 80 feet deep and short drifts. Ore worked in 12-foot arrastra, power obtained from Clear Creek. Two men employed. Some rich ore extracted.

Excelsior, prospect, in Mojave mining district, in Sec. 6, T. 10 N., R. 12 W., S. B. M., about 3½ miles south of Mojave. Owned by Hunter, Clark and Ischinger of Mojave. Holdings consist of 20 acres, at an elevation of 2800 feet. Vein 2 feet wide, quartz-porphyry walls. Workings consist of three shafts on vein, from 60 to 150 feet deep. Idle.

Exposed Treasure (see *Mojave Consolidated*).

Fair View, consists of 80 acres in Sec. 11, T. 9 N., R. 13 W., S. B. M., about 4 miles northwest of Rosamond Station. Owners, Pierce & Company, of Los Angeles. Elevation 2650 feet. Vein 2 feet wide, granite-porphyry walls. Workings consist of shaft 400 feet deep, four levels, 1500 feet of drifts and a stope 130 feet long. There is a gasoline hoist, and dwellings on the property. Reduction equipment consists of 10-stamp mill and 50-ton cyanide plant, operated by steam power. Idle since 1911.

Garnishee, prospect, consists of 40 acres in Sec. 35, T. 26 S., R. 32 E., M. D. M., in the Keyes mining district, about 3 miles south of Isabella, at an elevation of 3200 feet. Owner, H. Stavert. Vein is small, the pay ore occurring in bunches in granite. Workings consist of tunnel 460 feet long and 2000 feet of drifts. Some rich ore extracted a few years ago. Idle.

G. B., consisting of 22.5 acres, is located in Sec. 1, T. 30 S., R. 41 E., M. D. M., 1¼ miles southwest of Johannesburg, at an elevation of 3600 feet. Owners, G. B. Mining and Reduction Company of Randsburg. C. G. Illingworth, president; G. L. Caulfield, manager; J. MacFarlane, superintendent. The holdings consist of 22.5 acres. The deposit consists of a shear zone from 100 to 300 feet wide, containing numerous parallel ledges, in rhyolite. Ledges have a width of from

10 to 18 feet, strike N. 10° E., dip 30° to 50° E. Ore is free milling. Workings consist of four shafts from 150 to 260 feet deep, two levels, 1000 feet of drifts, crosscuts, raises, winzes, and a stope 700 feet long. Ore reserve 10,000 tons, of a value of $5 per ton. Caving system of mining used. Mine equipment consists of 10 h.p gasoline hoist, cars, tools, electric motor for blower, buildings, and electric lights in mine. Reduction plant consists of dry crushing mill equipped with two crushers, rolls and screens, run by 50 h.p. motor. Capacity of mill 60 tons in twenty-four hours; also cyanide plant consisting of ten tanks of 8 tons capacity each (experimental plant). Electric power costs 12 cents per ton. Total operating cost $3 per ton. Six men employed. Worked until 1910 by leasers, who extracted some good milling ore. Some of the sulphides run $3000 per ton in gold. Adjoining mines, Baltic on south and Yellow Astor on west.

Glen Olive, the largest producer in the Pioneer mining district, consists of 120 acres in Sec. 33, T. 27 S., R. 33 E., M. D. M., 42 miles north of Caliente, in the Sequoia Forest Reserve. Elevation at tunnel, 7500 feet. Owners, A. W. Stetson et al., San Francisco; F. A. Braden, superintendent. Two parallel veins, about 200 feet apart, known as Bulgarian Troubles and Russian Bear; average width 3 feet; strike northwest and southeast, dip N. 15° W. Ore free milling, giving returns of $25 per ton on the plates. Pay shoot about 200 feet long. Workings consist of two tunnels on vein 200 feet apart and each 700 feet long, several hundred feet of drifts, crosscut 320 feet long, raises, three winzes 100 feet deep. all stoped between tunnels. Mine is equipped with cars, 800 feet automatic tramway (use two cars), shops assay office, and dwellings. Reduction equipment consists of 10-stamp Hendy mill (1000-pound stamps) driven by gasoline, which costs 1 cents per gallon. Water obtained from springs. Tailings impounded in gulch. Production to date, $500,000. Mine closed down in May 1914, on account of general financial conditions, as the crosscut tunne must be extended to cut the vein so as to block out ore.

Gold Crown Consolidated, formerly known as Gold King Group, con sisting of 46 acres, patented, is located in Secs. 11 and 12, T. 30 S R. 40 E., M. D. M., 2½ miles south of Johannesburg in the Stringe mining district, at an elevation of 4000 feet. Owner, H. W. Mauby of Randsburg. Several veins from 5 to 20 feet wide in schist. Worke by means of shallow shafts and open cuts. Ore treated at Red Do custom mill. Cost of hauling and milling is $5.50 per ton. Net prof per ton $20. Two men employed. Small producer.

Golden Group, formerly known as Jack Rabbit, consisting of 100 acres, is located in Sec. 34, T. 30 S., R. 32 E., M. D. M., in the Amalie district, 8 miles east of Caliente, in the Sequoia Forest Reserve. Elevation 2000 feet. Owner, J. B. Ferris, of Caliente. The deposit is massive, the average width of pay ore being 20 feet, low grade, strike northwest and southeast, dip 45° N., granite walls. Workings consist of shaft 200 feet deep, three levels, 300 feet of drifts and stopes. Reduction equipment consists of Marathon tube mill (6 feet long and 3 feet diameter), operated by 24-foot overshot water wheel (see photo No. 8). Water from Caliente Creek through 10-inch pipe, 1000 feet long. Total production to date $5,000. Four men employed. Owner claims large ore reserve.

Photo No. 8. Water wheel operating "Marathon" tube mill, Golden Group.

Gold Peak, formerly known as the Zada, one of the producers of the Amalie mining district, is located in Sec. 28, T. 30 S., R. 33 E., M. D. M., 14 miles northeast of Caliente, in the Sequoia Forest Reserve. Holdings consist of 340 acres, patented. Owned by Gold Peak Mining Company, of San Francisco; H. H. Blood, president; F. Kramer, secretary. Bonded to Coulson Bros., of Los Angeles. Six veins; only one, the Zada, has been worked. Average width 10 feet, strike northwest and southeast, dip 40° E., quartz-porphyry walls. Pay shoot 300 feet long and 10 feet wide. Ore as a rule is free milling, but one vein carries base metals, being rich in sulphides of copper and silver. Workings consist of tunnel 450 feet long and several thousand feet of drifts and stopes. Mine equipment consists of machine drills, compressor plant, cars, ore bins, dwellings and assay office. Reduction plant consists of 20-stamp Hendy mill and four Frue concentrators, operated with gasoline engine. Idle. Tailings are impounded. Over $100,000 worth of ore shipped to smelter before mill was erected. Three men employed.

Gold State Group, a prospect, is located in Sec. 9, T. 29 S., R. 34 E., M. D. M., in the Green Mountain district, about 31 miles east of Caliente, at an elevation of 7300 feet. Owners, M. J. Errecart et al., of Loraine post office. Holdings consist of 100 acres, reached by a 7-mile trail from Piute post office. Vein is 10 inches wide, granite footwall and slate hanging. Slightly developed with shaft 80 feet deep, 200 feet of drifts, and one stope 80 feet long. Reduction plant consists of an old 12-foot arrastra, operated by steam power, wood being used as fuel. One man employed. Some high grade ore extracted. Total production $20,000.

Good Hope, formerly known as Good Hope and Kenyon, owned by Consolidated Mines Company, of Los Angeles; W. H. Herren, president; S. H. Ellis, secretary; Robert Lanka, superintendent. Consists of 156 acres (patented) in Sec. 35, T. 29 S., R. 40 E., M. D. M., 1 mile west of Johannesburg in the Rand mining district. Elevation 3550 feet. Two veins, Good Hope and Butte, strike east and west, dip 56° S., diorite walls, average width 20 inches. Pay shoot 300 feet long and 20 inches wide. Ore free milling. Workings consist of shaft 300 feet deep, five levels, and several thousand feet of drifts, raises, winzes and stopes. Mine equipment consists of 15 h.p. gasoline hoist, shop, ore bins, and dwellings. Reduction equipment consists of 5-stamp Union Iron Works mill, Blake rock crusher, settling tanks, and 30 h.p. motor, all operated with gasoline costing 25¢ per gallon. Water obtained from wells at Johannesburg. Tailings impounded to be cyanided at some future time. Eleven men employed. Cost (per ton): development $2, mining $2, treatment $1, general 50¢, making a total of $5.50. Adjoining mines: Yellow Astor, Big Butte, Little Butte and King Solomon.

Good Luck, a prospect, consists of 40 acres in Sec. 16, T. 27 S., R. 29 E., M. D. M., in the Long Tom mining district, about 21 miles northeast of Bakersfield, owned by A. P. Tucker, of Tulare. Elevation 1750 feet. Vein is small in granite, but rich. Pay shoot short. Slightly developed with tunnel 420 feet long, 200 feet of drifts, and a stope 40 feet long. Ore worked in 12-foot arrastra, driven by water power from Long Tom Creek. One man working.

Bibl.: Report XII, p. 191.

Grace Group, a prospect in the Mojave mining district, consists of 120 acres in Sec. 6, T. 10 N., R. 12 W., S. B. M., 4½ miles south of Mojave, at an elevation of 3400 feet. Vein is 20 inches wide, strike northwest and southeast, dip 60° N., granite-porphyry walls. Slightly developed with tunnel 450 feet long. Originally part of Karma group. Little high grade ore found. Adjoining mine: Queen Esther on the west.

Grey Eagle, formerly known as Echo, consists of 100 acres, patented, in Sec. 6, T. 10 N., R. 12 W., S. B. M., 4 miles south of Mojave, in the Mojave district, at an elevation of 3500 feet. Owner, A. Asher, of Mojave. Vein is 15′ wide, strike northwest and southeast, dip 50° W., granite-porphyry walls. Pay shoot is 240 feet long and 15 feet wide, low grade, with rich ore on footwall side; free milling. Workings consist of shaft 350 feet deep, three levels, 3000 feet of drifts and one stope 240 feet long. Old steam hoist, assay office and dwellings on the property. The former owners, Echo Mining Company, worked the ore in a 10-stamp mill which was removed in 1906. Owner claims a production record of $200,000. Idle since 1905.

Iconoclast, prospect, in the Valley View mining district, in Sec. 25, T. 27 S., R. 33 E., M. D. M., about 36 miles north of Caliente, consists of 60 acres, in the Sequoia Forest Reserve, owned by R. E. Porter. Elevation 8000 feet. Vein is 2 feet wide, free milling, granite footwall and slate hanging. Slightly developed with tunnel on vein 360 feet long. A little high grade ore extracted. Ore on dump said to run $30 per ton. One man employed.

Bibl.: Report XIII, p. 186.

Illinois and Golden Bell, prospect, in Pioneer mining district in Sec. 16, T. 27 S., R. 33 E., M. D. M., about 40 miles north of Caliente in Sequoia Forest Reserve, owned by J. Peep, of Bodfish P. O. Elevation 7800 feet. Holdings consist of 60 acres. Vein is 12 inches wide, slate footwall and granite hanging, free milling. Slightly developed with tunnel 310 feet long on vein. Worked as a pocket mine and $12,000 in gold said to have been extracted.

Indian Queen, a prospect, consisting of 40 acres, is located in Sec. 15, T. 27 S., R. 29 E., M. D. M., 22 miles northeast of Bakersfield, in the Long Tom mining district. Owner, R. E. Dosworth, of Tulare. Small vein, granite footwall, and diabase hanging. Workings consist of tunnel 80 feet long and short drifts. A little rich ore found.

Jeff Davis, one of the early producers of the Cove mining district, consists of 5 acres (patented in 1884) in Sec. 28, T. 25 S., R. 33 E., M. D. M., about ½ mile north of Kernville, in the Sequoia Forest Reserve, at an elevation of 2900 feet. Owners, Lady Belle Company, of Portland, Maine; president, Dr. R. C. Schupphaus; secretary, C. C. Hamilton; manager, C. S. Long, Kernville. Vein is 12 inches wide, granite walls, strike east and west, dip 70° N. Pay shoot is 350 feet long, and 12 inches wide, free milling ore, high grade. Workings consist of shaft 200 feet deep, one level, several hundred feet of drifts and a stope (350′ by 3′ by 150′). Ore stoped out from the level (150 feet), to the surface by leasers during the sixties. Production to date, $150,000. Adjoining mines: Orejana on south, Lady Belle on west, Bull Run on north, Summer on east.

Jennette, the largest producer in the Green Mountain mining district, consists of 40 acres in Sec. 22, T. 29 S., R. 34 E., M. D. M., about 25 miles northeast of Caliente, in the Sequoia Forest Reserve. Elevation 8000 feet. Owner, J. Lombard, of Piute post office. The vein has an average width of 6 inches, free milling, high grade ore, strike northeast and southwest, dip 40° S., granite walls. Workings consist of several tunnels on the vein, from 50 to 400 feet long, 2500 feet of drifts and stopes. Reduction equipment consists of 4-stamp mill, operated with steam power, wood being used for fuel. Seven men employed. Yearly production from $15,000 to $20,000. Ore runs $40 per ton. Adjoining mine: Gwinn to west.

Josephine Group, a consolidation of several old properties in the Woody mining district, consists of 150 acres, patented, and 150 acres held by location, in Secs. 2, 3, 4, 5 and 8, T. 25 S., R. 29 E., M. D. M., about 5 miles southeast of White River post office. Owner, W. Adams, of Corinth, Miss. Elevation 4000 feet. The claims included in this group are Josephine, Ballard, Last Chance, Mountain View, Banner, Alta, Queen, Vulture (patented), and Missouri, Yankee and Perseverance groups. Six parallel veins, average width 2 feet, strike east and west, dip 45° E., quartz-porphyry footwall and slate hanging, free milling ore. Main workings are on the Josephine and consist of a tunnel 300 feet long, 120-foot crosscut, 1000 feet of drifts and a stope 80′ by 3′ by 70′. Several open cuts on other claims. Reduction equipment consists of a 5-foot Huntington mill run by steam power, wood being used for fuel. One man employed. Josephine was a good producer some years ago.

Bibl.: Reports XII, p. 145; and XIII, p. 191.

Josephine T. G. Group, consists of 70 acres in the Rand district, miles southwest of Randsburg, and adjoining the Yellow Aster min on the southwest. Owner, J. P. Howe, of Randsburg. Elevation 4000 feet. Deposit consists of quartz fissures in schist. Workings consist of several shafts from 20 to 150 feet deep, 400-foot crosscut, and a number of open cuts. Ore is free milling and shipped to Red Dog custom mill. Total operating cost, including milling, about $20 per ton. Equipment consists of 8 h.p. gasoline hoist, skids, buckets, cars and tools. Three men employed. Production to date $11,500.

Karma, owned by the Karma Mining Company, of San Francisco, R. Trost, president, E. L. Wigman, superintendent. Consists of 30 acres in Sec. 6, T. 10 N., R. 12 W., S. B. M., about 4 miles south of Mojave, in the Mojave district, at an elevation of 3200 feet. Two parallel veins, average width 15 feet, strike north and south, dip 60° E., granite-porphyry walls. Pay shoot 240 feet long and 15 inches wide. Ore free milling, needs fine grinding. Workings consist of a tunnel 1800 feet long on vein, shaft 160 feet deep, drifts and stope 240 feet long. Mine equipment consists of cars, steam hoist, assay office, shops, ore bins and dwellings. Ore reduced in a 20-stamp mill, steam driven. Idle. Water obtained from Soledad Pipe Line Company. Three men employed. Property only worked to a limited extent since 1904. Said to have produced $300,000. Adjoins Double Standard mine on the west.

Kern County Consolidated Gold Mines, formerly known as Gwynne, a small producer in the Green Mountain district, is located in Sec. 22, T. 29 S., R. 34 E., M. D. M., about 25 miles northeast of Caliente, in the Sequoia Forest Reserve. Owners, Kern County Consolidated Gold Mines Company. F. W. Gwynne, president, J. Ross, superintendent, Piute post office. Holdings consist of 40 acres, patented, at an elevation of 7500 feet. Vein has an average width of 14 inches, strike northeast and southwest, dip 40° S. Short pay shoot, free milling. Workings consist of a shaft 300 feet deep, three levels, several hundred feet of drifts, stopes and a tunnel on the vein 1500 feet long. Mine equipment consists of 30 h.p. steam hoist, cars, skip, shop and dwellings. The ore is reduced in a 3-stamp Hendy mill (850-pound stamps), operated with steam power, wood being used for fuel. Some rich ore mined. Five men employed. It adjoins the Jennette mine on the east.

Keyes, formerly known as the Old Keyes, located in 1852 by Colonel Keyes, is one of the famous mines of Kern County. The holdings consist of 100 acres in Sec. 26, T. 26 S., R. 32 E., M. D. M., in Keyes district, about 3 miles southeast of Isabella, in the Sequoia Forest Reserve, at an elevation of 3600 feet. Owners, Keyes Mining Company, of San Diego. J. L. Hooper, president, Geo. Stavent, superintendent. The vein (Keyes) is 2 feet wide, strike northeast and southwest, dip 70° E., granite walls, free milling, high grade. Workings consist of several thousand feet of tunnels, drifts and stopes. Maximum depth about 450 feet. Mine equipment consists of cars, shops, assay office and dwellings. Ore is reduced in a new 5-stamp mill (1100-pound stamps), operated by distillate, costing about 8¢ per gallon. Nine men employed. Producer.

Bibl.: Reports XII, p. 145; and XIII, p. 191. U. S. G. S., Mineral Resources of U. S.

Keysville Placer, consists of 40 acres in Sec. 36, T. 26 S., R. 32 E., M. D. M., about 3 miles southeast of Isabella, in the Sequoia Forest Reserve, owned by G. Henschkel. Elevation 3400 feet. Old river deposit, worked in winter by ground sluicing. Course of channel northwest and southeast, granite bedrock, pay gravel 5 to 10 feet deep, easily worked, small producer.

King Solomon Consolidated Mines Company, consists of 90 acres, in Sec. 35, T. 29 S., R. 40 E., M. D. M., ¾ of a mile west of Johannesburg in the Rand district. Owners, King Solomon Consolidated Mines Company, of Los Angeles. E. Shipsey, president; J. Shipsey, superintendent. Elevation 3900 feet. Vein is 3 feet wide, granite footwall and porphyry hanging. Pay shoot said to be 1400 feet long, free milling. Workings consist of a shaft 520 feet deep, levels every 50 feet, 1400-foot drift and stopes. Mine equipment consists of a 20 h.p. West Coast hoist, cars and ore bin. Ore is reduced at Red Dog custom mill. Ten men employed. Adjoining mines, Butte and Gold Consolidated.

King Solomon Gold Mining Company, formerly known as the Pleasant View, the largest producer in the Clear Creek district, is owned by the King Solomon Gold Mining Company, of Los Angeles. B. Hohn, president; Mrs. J. Hayes, secretary. Leased to C. E. Benton. The holdings consist of 100 acres, in Secs. 9 and 10, T. 28 S., R. 33 E., M. D. M., about 4 miles east of Havilah, in the Sequoia Forest Reserve, at an elevation of 6500 feet. The vein is 3 feet wide, strike northeast and southwest, dip 60° S., granite walls. Pay shoot 300 feet long, free milling. Workings consist of a shaft 300 feet deep, three levels, short drifts, and one stope. Mine equipment consists of a steam hoist, two 30 h.p. boilers, cars, assay office, shop and dwellings. Ore is reduced in a 5-stamp Hendy mill (1000-pound stamps), operated with steam power, wood being used for fuel. Six men employed. Said to have produced $40,000 since 1912.

La Cross, a prospect, consists of 20 acres in the Stringer mining district in Sec. 2, T. 30 S., R. 40 E., about 1½ miles south of Randsburg, at an elevation of 4000 feet. Owner, H. Putnam, of Los Angeles. Vein is small, averaging 6 inches, high grade; albite schist forms the walls. Idle on account of litigation.

Lady Belle, one of the famous producers of the Cove district, consists of two full claims (the Lady Belle and Boston Belle, the former claim patented in 1884), located in Sec. 28, T. 25 S., R. 33 E., M. D. M., in the Sequoia Forest Reserve, and about ½ mile north of Kernville. Owners, Lady Belle Company, of Portland, Maine. Dr. R. C. Schupphaus, president; C. S. Long, manager, Kernville. Elevation 3100 feet. Lady Belle vein has a width of 3 feet, strike east and west, dip 65° N., granite walls. Pay shoot is 250 feet long and 3 feet wide, free milling. Property has been worked since 1861, and at one time supported a number of lessees as the ore is high grade and easily mined. The workings consist of a shaft 372 feet deep, four levels, several thousand feet of drifts and three stopes each 200 feet long. Ore reserves 4000 tons, value $35 per ton. The mine equipment consists of steam hoist, two Cameron pumps, assay office, ore bins and cars. Ore reduced at the 10-stamp mill on Kern River. Total cost of mining and milling at present is about $5 per ton. Three men employed. One run of 1500 tons of ore gave $40 on the plates. Production to date about $500,000. Adjoining mines: Big Hill, Pinnacle, and Penn cut on south, Jeff Davis and Bull Run on east, S. F. Belle and Frank on north.

Lida, also known as the Hamilton, consists of 180 acres in Sec. 11, T. 9 N., R. 13 W., S. B. M., about 5 miles northwest of Rosamond, at an elevation of 2800 feet. Owners, Milwaukee Mining Company, of Milwaukee, Wis.; C. H. Watkins, president and manager; Geo. Bert, superintendent. The vein is 2 feet wide, granite footwall and slate hanging, strike northeast and southwest, dip 25° S., free milling. Workings consist of a shaft 320 feet deep, three levels, 2000 feet of drifts, and a stope 200 feet long. Mine equipment consists of steam hoist, cars, assay office, ore bin, shops and dwellings. Oil is used for fuel. A 10-stamp mill (1000-pound stamps), and a 25-ton cyanide plant comprise the reduction equipment. Water obtained from springs. Six men employed. Property said to have a production record of $200,000. Small producer at present.

Little Angel, formerly known as Warrington, consists of 40 acres, in Clear Creek district in Sec. 2, T. 28 S., R. 32 E., M. D. M., in Sequoia Forest Reserve, about 30 miles north of Caliente. Owner, S. C. Smith, of Havilah post office. Vein is small, but high grade. Short ore shoot in granite. Slightly developed with a tunnel 320 feet long on the vein, a 60-foot raise and one stope 80 feet long. Small producer some years ago.

Bibl.: Report XIII, p. 192.

Little Bonanza, a prospect in the Green Mountain mining district, in Sec. 35, T. 26 S., R. 32 E., M. D. M., about 5 miles south of Isabella, in the Sequoia Forest Reserve, consists of 20 acres. Elevation 4100 feet. Owner, A. R. Lucy, of Isabella. Small vein in slate and granite. A tunnel 140 feet long on vein and short drifts comprise the development work. Worked as a pocket mine. Adjoins the Mammoth mine on the west.

Bibl.: Report XII, p. 191.

Little Butte, consists of 60 acres in the Rand district in Sec. 35, T. 29 S., R. 40 E., M. D. M., about 1 mile west of Johannesburg, at an elevation of 3600 feet. Owners, Little Butte Mining and Milling Company, of Los Angeles; C. W. Clark, president; Dr. J. W. Oakley, secretary; R. F. Dickinson, superintendent. Vein 4 feet wide, free milling, diorite footwall and porphyry hanging. Workings consist of a shaft 610 feet deep and 3500 feet of drifts. Equipment consists of 25 h.p. gasoline hoist, skip, cars and 2-stamp mill. Distillate, costing 20¢ per gallon, used for fuel. Ore shipped to Red Dog custom mill. Worked since 1907 by lessees. A production record of $150,000 is claimed.

Long Tom, consisting of 120 acres, patented, was the first discovery in the Long Tom mining district, and the largest producer. This group is located in Sec. 21, T. 27 S., R. 29 E., about 20 miles northeast of Bakersfield, at an elevation of 1600 feet. Owner, H. Herschfeld, of Bakersfield. The vein has a width of 16 inches, strike northwest and southeast, dip 45° N., diabase footwall and granite hanging, free milling. Workings consist of a shaft 380 feet deep (sunk at an angle of 45°), several thousand feet of drifts, and stopes 150 feet long. All ore has been stoped from the 300-foot level to the surface. Equipment consists of dwellings and 20-stamp mill (850-pound stamps). Idle. Property was a noted producer some years ago but is now only worked to a limited extent. Some of the old workings are caved. Two men employed.

Bibl.: Report XI, p. 238.

Mammoth, also known as the Harrison, is the largest mine in the Keyes district, and has been in operation over sixty years. This group, consisting of 100 acres, is located in Sec. 35, T. 26 S., R. 32 E., M. D. M., about 5 miles south of Isabella, in the Sequoia Forest Reserve, at an elevation of 3900 feet. Owners, Mammoth Mountain Mining Company, of Los Angeles; H. M. Russell, president; A. G. Keating, manager. The Mammoth vein is 2 feet wide, strike northeast and southwest, dip 70° E., slate footwall and granite hanging, free milling ore. Workings consist of a tunnel on the vein 700 feet long, and several thousand feet of drifts, stopes, and raises. Mine equipment consists of cars, shops, assay office and dwellings. The ore is reduced in a 10-stamp mill (1100-pound stamps), driven by electric power from the Pacific Light and Power Company. Nine men employed. Producer.

Bibl.: Reports VIII, p. 314; and XIII, p. 193.

Mascot Group, 5 miles southwest of Randsburg, in the Rand mining district, consists of 60 acres. Owned by G. M. Humphrey, of Randsburg. Elevation, 3000 feet. Small vein of high grade ore in schist, free milling. Extent of ore body not determined. A shaft 50 feet deep and a short drift constitute the workings. Ore is reduced in Red Dog custom mill. Three men employed. Cost of mining and milling, about $20 per ton. Ore plates from $50 to $75 per ton.

McKidney, consisting of 60 acres, in Sec. 9, T. 28 S., R. 32 E., M. D. M., about 28 miles north of Caliente, in the Sequoia Forest Reserve, is a small producer in the Clear Creek district. Elevation, 4300 feet. Owner, D. Fergusin, of Havilah post office. Three parallel veins, but only one, the McKidney, has been worked. Average width, 2 feet, strike northeast and southwest, dip 78° S., syenite footwall and granite hanging. Ore free milling and runs from $20 to $100 per ton in free gold. Workings consist of a shaft on vein 230 feet deep, two levels and 1000 feet of drifts and stopes. Mine equipment consists of a gasoline hoist, two engines (10 and 20 h.p.) one Burleigh drill, compressor plant, tools and dwelling. Three men employed. Adjoining mine: American Golden Eagle on the west.

Bibl.: Report XIII, p. 193.

Minnehaha, a small producer of the Rand district, consists of 80 acres in Sec. 2, T. 29 S., R. 40 E., M. D. M., about 3 miles west of Johannesburg, at an elevation of 3800 feet. Owners, E. B. Maginnis et al., of Randsburg. Small vein, high grade ore, milling, $100 per ton. Workings consist of four tunnels, each 400 feet long, and four shafts each 100 feet deep. Ore reduced in Red Dog custom mill. Three men employed. Production to date, $35,000.

Minnie E. Group, consists of 40 acres, in Sec. 28, T. 25 S., R. 33 E., M. D. M., in the Cove district, about 1 mile north of Kernville, in the Sequoia Forest Reserve, at an elevation of 2950 feet. Owners, Lady Belle Company, of Portland, Me.; Dr. A. C. Schupphaus, president; C. S. Long, manager, Kernville. Prospect. Undeveloped.

Minnesota Group, formerly known as King George. A small producer of the Rand mining district, in Sec. 35, T. 29 S., R. 40 E., M. D. M., about 3 miles south of Randsburg, at an elevation of 4000 feet. Owner, D. Gunderson. Holdings consist of 50 acres located in 1896. Small vein in schist. Ore runs $68 per ton in free gold. Workings consist of three shafts, each 100 feet deep and short drifts. Mine equipment consists of horse-whim, car and dwelling. Ore reduced at Red Dog custom mill. Three men employed. Produced $10,000 to date. Adjoins Josephine group on the east.

Mojave Consolidated Gold Mines, formerly known as Exposed Treasure, the largest producer in the Mojave mining district, is located in Sec. 32, T. 11 N., R. 12 W., S. B. M., about 3½ miles south of Mojave, on south side of Soledad Butte. The holdings, consisting of 280 acres, patented, and 60 acres held by location, are owned by the Mojave Consolidated Gold Mines, of Los Angeles; C. B. Campbell, president; W. H. Taylor, secretary; C. F. Nourse, superintendent. Property acquired by present owners in 1912. There are six parallel veins on claims known as Mill, Assay Office, Golden Carrier, Yellow Rover, Boston and Exposed Treasure. These veins vary in width from 100 to 1000 feet, strike northwest and southeast, dip 30° E., granite footwall and quartz-porphyry hanging. Pay shoots 1500 feet long and 100 feet wide, free milling. Workings consist of several shafts on the vein, the deepest 900 feet, nine levels, over 2 miles of drift, crosscuts and stopes. One stope is 900 feet long on Exposed Treasure claim. Several hundred thousand tons of ore in sight. Ore showing free gold in bottom of 900-foot shaft on Exposed Treasure. Shrinkage stope method of mining used. Mine equipment consists of cars, compressor plant, machine drills, shops, assay office, ore bins, dwellings, 3½ miles of telephone line to Mojave, three steam hoists, several mine pumps and two Moreland

Photo No. 9. Mill at Mojave Consolidated Mine.

auto trucks. Reduction equipment consists of 20-stamp mill (1100-pound stamps) and a 60-ton cyanide plant (nine sand vats and three slime agitators) (see photo No. 9). Crude oil used as fuel. Water obtained from Soledad Pipe Line Company. Fifty men employed. Daily production, 60 tons. Production record to date about $2,000,000.

Bibl.: Transactions Am. Inst. Min. Engineers, Vol. XXXVII, pp. 168–176; XXXVIII, pp. 310–319.

Monarch Tungsten Gold Mining Company, a prospect in the Rand mining district, in Sec. 1, T. 30 S., R. 40 E., M. D. M., about 1½ miles south of Johannesburg, at an elevation of 3800 feet, consists of 50 acres, owned by W. A. Wise et al., of Los Angeles. Slightly developed with shallow shafts. Ore has not been found in place (gold and tungsten float). Joins Baltic on east. Idle.

Nellie Dent and Content, consists of 54.3 acres, patented in 1874, in Secs. 28 and 33, T. 25 S., R. 33 E., in Cove mining district, about ½ mile of Kernville, in the Sequoia Forest Reserve, at an elevation of 3100 feet. Owners, Kern Development Company of Portland, Maine. C. S. Long, president and manager, Kernville. Vein has an average width of 130 feet (low grade), between granite walls, strike S. 27° W., dip 68° W. Pay shoot on surface can be traced for 4200 feet by the croppings, free milling. Workings on Nellie Dent claim consist of a shaft 150 feet deep, a drift 450 feet long and one stope 450 feet in length, from which $100,000 was extracted. Report by C. W. Kempton states 1,000,000 tons of ore in sight on Content claim; also hat 50 feet of ledge gave returns of $5 per ton in gold, and that deposit an be worked by open cut method of mining. Raymond, U. S. Commis-ioner of Mineral Statistics, in 1875, stated that "the vein on the Nellie Dent mine is 200 feet wide between walls, and carries ore yielding up to 10 or $12 per ton." Adjoining mines: Big Blue to north, Arroyo to orthwest, Lyna and Blue Gouge No. 3 to northeast, and Maverick to outhwest.

Old Cowboy, consists of 80 acres in Sec. 28, T. 30 S., R. 33 E., M. D. M., in Amalie District about 14 miles northeast of Caliente, in the equoia Forest Reserve, at an elevation of 2800 feet. Owner, A. E. ryson, of Los Angeles. The vein has an average width of 12 feet, uartz-porphyry walls, strike northeast and southwest, dip S. 40° E. ay shoot 230 feet long and 12 feet wide (3 feet paid to ship), free milling. Workings consist of tunnel on vein 520 feet long, and sev-ral hundred feet of drift and stopes. Worked at times by lessees ho extracted about $60,000 worth of shipping ore. Idle at present. djoins Gold Peak mine on west.

Ophir, consists of 40 acres, patented, in Sec. 11, T. 28 S., R. 32 E., M. D. M., in the Clear Creek district, about 29 miles north of Caliente, in the Sequoia Forest Reserve, at an elevation of 4200 feet. Owner, J. E. Waters, of Havilah post office. Vein is 4 feet wide, slate walls. Development work consists of a tunnel on the vein 420 feet long, several shallow shafts, 600 feet of drifts and one stope 130 feet long. Ore worked years ago in 5-stamp mill, which has been removed to the King Solomon mine. Owner claims that property produced $90,000. Idle.

Bibl.: Report XIII, p. 194.

Oro Fino, one of the early producers of the Clear Creek mining district, consisting of 60 acres, patented, in Sec. 3, T. 28 S., R. 32 E., M. D. M., about 30 miles north of Caliente, in the Sequoia Forest Reserve, is owned by J. A. Bouquet, of San Francisco. The vein is 4 feet wide, granite walls, strike northeast and southwest, dip 72° E. Workings consist of a tunnel on the vein 230 feet long and several hundred feet of drifts and stopes. Ore was milled in the custom mill at Havilah, now removed. Property said to have produced $100,000. Ore was rich in free gold.

Bibl.: Report XIII, p. 194.

Pickwick, a prospect, in Sec. 3, T. 27 S., R. 33 E., M. D. M., in the Pioneer district, about 35 miles north of Caliente, in the Sequoia Forest Reserve, consists of 80 acres, owned by John Ross of Bodfish. Small vein in granite, pay ore found in pockets. Slightly developed with a crosscut tunnel 180 feet long, which cuts the vein at a distance of 155 feet from the portal. Small producer. Worked by owner.

Pine Tree, also known as American, the only gold mine in the Tehachapi district, consists of 190 acres (170 patented and 20 held by location), in Secs. 3 and 4, T. 11 N., R. 15 W., S. B. M., about 6 miles south of Tehachapi, owned by Geo. Gordon. Elevation 5000 feet. Two parallel veins but only one, the Pine Tree, has been worked, 4 feet wide, strike northeast and southwest, dip 45° E., granite walls. Pay shoot 250 feet long and 4 feet wide, free milling. Workings consist of several tunnels on vein (longest 800 feet), and several thousand feet of drifts and stopes. Mine equipment consists of cars, shops and dwellings. Ore was reduced in a 4-foot Huntington mill, wood being used for fuel. Produced $250,000 from 1876 to 1907. Idle at present.

Bibl.: Report XIII, p. 194.

Piute Consolidated, a prospect, consists of 100 acres, in Valley View district, in Sec. 13, T. 28 S., R. 34 E., M. D. M., about 42 miles north of Caliente, in the Sequoia Forest Reserve, at an elevation of 7500 feet. Owner, R. L. Wilson, of Havilah. Vein is 2 feet wide, strike northeast and southwest, dip 45° S., granite footwall and quartz-porphyry hanging. Pay shoot 150 feet long, free milling. Workings consist of a crosscut tunnel 300 feet long, cutting the ore at a distance of 150 feet from the portal, short drifts and open cuts. Ore reduced in a 4-stamp mill on Clear Creek. Leased by Wilson. Owner in 1913 saved $2,500 on the plates from 80 tons of ore.

Phoenix Development Company, formerly known as Valverde, a prospect in Sec. 35, T. 29 S., R. 40 E., M. D. M., about ½ mile north of Johannesburg in Rand district, owned by Mrs. C. A. Burcham, of Randsburg. Elevation 3800 feet. Vein is large, but pay ore found in small lenses, schist formation. Equipment consists of 5-stamp mill and one stamp battery, operated by 15 h.p. gasoline engine, and a small friction hoist. Development work consists of shallow shafts and short drifts. Property produced $30,000. Idle.

Pinmore, prospect, formerly known as Crœsus, consists of 40 acres, in Sec. 26, T. 29 S., R. 40 E., M. D. M., in Rand district, about 1 mile north of Johannesburg. Owned by Los Angeles Company. Small veins in schist. Equipment consists of 15 h.p West Coast gas engine, skip and cars. The 10-stamp mill destroyed by fire. Company paid $5,000 in dividends in two years. Idle.

Placer Gold Company (placer), consists of 60 acres in Sec. 1, T. 30 S., R. 40 E., M. D. M., about ½ mile south of Johannesburg, in the Rand district, at an elevation of 3500 feet. Owners, Placer Gold Company, of Los Angeles; E. Dunham, president; H. R. Wynn, superintendent. Deposit consists of igneous materials from the surrounding hills. Worked by sluicing and concentrating on cocoa matting, then the coarse is crushed through a Bronze reduction mill and then over Cummings concentrating tables, the gold being extracted n amalgam barrel and the tungsten shipped to smelter. Water obtained from Randsburg Water Company and Santa Fe Railroad. Gasoline used for power, costing about 7¢ per cubic yard for gravel handled. Net profit per cubic yard $1.30. Plant handles 100 cubic yards daily. Six men employed. Ground worked from 1898 to 1913 y "dry wash" method.

Polar Bear, a prospect, consists of 80 acres, in Sec. 29, T. 27 S., R. 33 E., in the Pioneer mining district, about 34 miles north of Caliente, in the Sequoia Forest Reserve. Elevation 3200 feet. Small eins in granite. Worked for "pockets" by G. F. Haskins, the owner. One tunnel on vein 210 feet long. Produced $8,000 to date.

President, a prospect, consists of 20 acres in Sec. 4, T. 27 S., . 32 E., M. D. M., in the Keyes district, about 5 miles south of

Isabella, in the Sequoia Forest Reserve, at an elevation of 3200 feet. Owner, U. T. Smith. Short pay shoot, granite footwall and granodiorite hanging. Tunnel on vein 465 feet long and 150 feet of drifts. Idle.

Pyramid, a prospect, in the Stringer mining district, about 5 miles northeast of Johannesburg, consists of 40 acres at an elevation of 4000 feet, owned by B. Ostick, of Randsburg. Small vein in schist. Workings consist of shaft 200 feet deep and 200 feet of drifts. Hoisting done with horse-whim. Property idle. Ostick also owns the Tip Top custom mill (5 stamps), near Atolia.

Queen Esther, one of the famous mines of the Mojave district, consists of 160 acres in Sec. 6, T. 10 N., R. 12 W., S. B. M., 4 miles south of Mojave, at an elevation of 3200 feet. Owners, Queen Esther Mining and Milling Company, Central Building, Los Angeles; S. W. Mudd, president; A. A. Burnard, manager; Gus Colberg, watchman. The vein has an average width of 8 feet, strike northwest and southeast, dip 40° E., granite-porphyry footwall and quartzite hanging. Pay shoot 500 feet long and 8 feet wide, free milling. Underground workings consist of several tunnels on the vein, drifts and stopes, making in all over 3500 feet of development. Equipment consists of cars, steam hoist, shops, office and dwellings. The reduction equipment consists of a 100-ton Cornish roll mill, and cyanide plant. Water obtained from Soledad pipe line. Property discovered in 1894 and worked until August, 1910, during which time several hundred thousand dollars in gold was extracted. Rich ore was shipped from the surface.

Rainbow, a prospect, 5 miles southwest of Johannesburg, in th Stringer district, consists of 30 acres, owned by B. Ostick, of Rands burg. Small vein in schist. Workings consist of a tunnel on vein 10 feet long and shallow shafts. A little ore shipped to his custom mil at Atolia. Owner doing assessment work.

Rand, a prospect in the Clear Creek mining district, consists of 2 acres in Sec. 3, T. 28 S., R. 32 E., M. D. M., about 25 miles nort of Caliente, in the Sequoia Forest Reserve, at an elevation of 4500 fee Owner, G. E. Bennett, of Caliente. The vein is 1 foot wide in granit free milling. Workings consist of a tunnel on the vein 500 feet lon and 400 feet of drifts. Two men driving a crosscut tunnel (contra work).

Rawhide, a prospect, consists of 40 acres in Sec. 28, T. 29 S R. 34 E., M. D. M., in the Green Mountain district, about 23 mil northeast of Caliente, in Sequoia Forest Reserve, at an elevation of 70 feet. Owner, A. R. Bulong, of Piute post office. Vein is 18 inches wid strike north and south, dip 30° E., granite walls, free milling ore, high grade. Workings consist of a tunnel on the vein 380 feet long and 250 feet of drifts. Two men employed. Small producer.

Red Hill, owned by Orejana Mining Company, of Hayward, Cal.; C. S. Long, president and manager; consists of 24 acres (4 acres patented), in Sec. 21, T. 25 S., R. 33 E., M. D. M., in the Cove mining district, about ½ mile north of Kernville, in the Sequoia Forest Reserve, at an elevation of 3500 feet. Three parallel and three cross veins, slate footwall and granite hanging. Croppings on surface are 125 feet wide and carry some values in gold. A short tunnel and several open cuts onstitute the development work. Adjoining mines: Zadel, Stirrup and Queirolo on west, Mystic on north, and northeast extension Sumner on outh.

Red Hill Group, consists of 220 acres in Secs. 16 and 21, T. 25 S., R. 33 E., M. D. M., in the Cove district, about 1 mile north of Kernille, in the Sequoia Forest Reserve, at an elevation of 3600 feet. Owner, Orejana Mining Company, of Hayward; C. S. Long, president nd manager. Three parallel veins having an average width of 10 feet. Lode outcrops for a distance of 8500 feet. Prospect.

Rose, a prospect, consists of 20 acres, patented, in Sec. 31, T. 26 S., . 32 E., M. D. M., in the Greenhorn Mountain district, about 8 miles utheast of Isabella, in Sequoia Forest Reserve, at an elevation of 6000 et. Owner, George King, of Isabella. Vein is 3 feet wide, strike rtheast and southwest, dip 60° E., slate footwall and granite hanging. orkings consist of shaft 140 feet deep, 700 feet of drifts, and a cross-ut tunnel 230 feet long. A little high-grade ore found. Idle.

Royal Bohn, a prospect in the Rand district, consists of 140 acres bout 5 miles southwest of Randsburg, owned by A. M. Powell. Small in in schist. Ore shipped to Red Dog custom mill. Small producer. me tungsten mined. Three men employed.

Rustler and San Diego, a prospect adjoining the Yellow Astor mine the west, consists of 40 acres in Sec. 2, T. 29 S., R. 40 E., M. D. M., out 1 mile west of Randsburg, in the Rand district. Owners, E. B. aginnis and J. T. O'Leary, of Randsburg. Large body of low grade e in schist and rhyolite, but only the high-grade streaks are worked. ree short tunnels and shallow shafts constitute the workings. Ore ipped to Red Dog custom mill. Two men employed. Small producer.

Santa Ana Gold Mines, formerly known as Napoleon Consolidated, a oducer, consists of 40 acres in Sec. 11, T. 30 S., R. 40 E., M. D. M., out 2½ miles southwest of Randsburg, in the Stringer district, at an vation of 4000 feet. Owner, Santa Ana Gold Mines Company, of

Los Angeles; F. Layton, president; J. Montgomery, secretary. Small vein in schist, high-grade ore, free milling. Workings consist of several shafts from 40 to 300 feet deep. Equipment consists of 15 h.p. Fairbanks-Morse gas engine, cars and shop. Distillate used as fuel, costing 20¢ per gallon. Ore is shipped to Red Dog custom mill. Property worked from 1896 to 1903 by the company, but since that time by lessees. A production record of $400,000 is claimed.

Shoestring, a prospect, consists of 20 acres in Sec. 12, T. 27 S., R. 32 E., M. D. M., in the Keyes district, about 4 miles south of Isabella, in the Sequoia Forest Reserve, at an elevation of 2800 feet. Owner, Geo. King, of Isabella. Small vein in granite, high-grade ore, free milling. Workings consist of a tunnel on vein 430 feet long and 600 feet of drifts. Idle.

Sidney Group, a small producer in the Rand mining district, consists of 260 acres in T. 30 S., R. 40 E., M. D. M., at an elevation of 4300 feet. Owner, A. C. White, of Randsburg. Several parallel veins in schist. Ore is free milling and runs from $10 to $200 per ton in gold. Shipped to Red Dog custom mill. Average profit per ton, $35. Workings consist of several shafts from 50 to 325 feet deep, 2000 feet of drifts and a number of stopes. Equipment consists of two gasoline hoists (18 h.p. and 50 h.p.), compressor plant, capacity three Ingersoll drills, shop and dwellings. Owner employs from three to ten men. Total production, $200,000.

Silver Boy, a prospect adjoining the Queen Esther mine on the east, consists of 80 acres in Sec. 6, T. 10 N., R. 12 W., S. B. M., in the Mojave district, about 3½ miles south of Mojave, at an elevation of 3000 feet. Owner, Gus. Colberg, of Mojave. Vein is 4 feet wide, quartzite footwall and granite-porphyry hanging. Slightly developed with shaft 100 feet deep and 200-foot drift. A shipment of 200 tons of ore to Selby smelter gave returns of $20 per ton in gold and $10 in silver.

Southern Cross Group, consists of 240 acres in Secs. 3 and 10 T. 28 S., R. 32 E., M. D. M., in the Clear Creek district, about 29 mile north of Caliente, in the Sequoia Forest Reserve, at an elevation of 4200 feet. Owner, A. Nielson, of Havilah post office. Vein is 20 feet wide granite footwall and syenite hanging, strike northeast and southwest dip 50° S. Ore free milling, low grade. Workings confined to th Mountain King claim and consist of a tunnel on the vein 360 feet long 500 feet of drifts, and several open cuts. Two men employed.

Stanford, a prospect adjoining the Sunshine on the southwest, con sists of 75 acres in Sec. 11, T. 30 S., R. 40 E., in Rand distric about 4 miles west of Johannesburg, at an elevation of 3800 fee Owner, Sam Montgomery. Small vein in schist. Free milling ore, hig grade. Workings consist of a shaft 425 feet deep and several thousand feet of drifts and stopes. Equipment consists of a 12 h.p. gasoline hoist, a horse-whim, cars, shop and dwellings. Worked to a limited extent by lessees. Small producer.

Summit Group, adjoining the Bright Star mine on the east, consists of 120 acres in Sec. 11, T. 28 S., R. 34 E., M. D. M., in the Green Mountain district, about 35 miles northeast of Caliente, in the Sequoia Forest Reserve. Owner, E. Roble, of Los Angeles. The vein is 2 feet wide, slate walls, and is an extension of the Bright Star lead. Workings consist of a shaft 100 feet deep and 1000 feet of drifts. Ore is free milling and runs $50 per ton. Two men employed. Prospect.

Sumner and North Extension, a famous producer in the pioneer mining days of Kern County, consists of 18 acres, patented in 1874, in Sec. 28, T. 25 S., R. 33 E., M. D. M., in the Cove district, about ½ mile north of Kernville, in the Sequoia Forest Reserve, at an elevation of 3000 feet. Owners, Kern Development Company of Portland, Maine, C. S. Long, president and manager; C. C. Hamilton, secretary. Local office, Kernville. Six veins; three parallel veins have an average width of 80 feet, slate footwall and granite hanging, strike N. 20° W., dip 70° W. (on Sumner claim). The three cross veins are smaller, having a width of 2 feet and are on the North Extension claim. The main workings are on the Sumner claim and consist of four shafts from 40 to 240 feet deep, three levels at 80′, 160′ and 240′; 2500 of drifts and two stopes, one 700 and the other 300 feet long. Ore is ree milling. Equipment consists of a steam hoist, compressor plant, ars and shop. Ore reduced in 10-stamp mill on Kern River. Sumner laim has produced $600,000. Adjoining mines: Jeff Davis, Bull Run, Frank, and Orejana on the west, Big Blue on the south, North Extenion Sumner on the north. Raymond in Seventh Annual Report of U. S. Commissioner of Mining Statistics, states: "That the Sumner roduced, in 1874, 5000 tons of ore with an average yield per ton of 40, total bullion product $200,000, number of stamps 16, cost of mining er ton $2.50, cost of milling per ton $2, kind of power and amount, water, no limit."

Bibl.: Report VIII, p. 315. U. S. Commissioner of Mining Statistics, Seventh Report.

Sunset, a prospect, consists of 40 acres in Sec. 10, T. 27 S., R. 32 E., M. D. M., in the Pioneer district, about 33 miles north of Caliente in the Sequoia Forest Reserve. Owner, C. E. Pierrel, of Bodfish post office. mall vein of high grade ore in granite, free milling. Slightly developed ith tunnel on vein 230 feet long. Worked by owner.

Sunshine, a prospect, consists of 18 acres, patented, in Sec. 11, T. 30 S., R. 40 E., M. D. M., in the Stringer district, about 2½ miles southwest of Johannesburg. Owner, T. W. Atkinson, of Randsburg. Small vein in schist. A shaft 500 feet deep and numerous drifts and stopes comprise the workings. Mine equipment consists of 25 h.p. gasoline hoist, air compressor, four machine drills and pumping plant to bring water from Johannesburg to the claim. Reduction equipment consists of a 3-stamp mill and cyanide plant, operated by gasoline. Idle.

Sunrise, a prospect, consists of 20 acres, in Sec. 10, T. 26 S., R. 29 E., M. D. M., in the Woody mining district, about 25 miles east of MacFarland. Owner, A. W. McRae, of Bakersfield. Vein is 2 feet wide, schist footwall and granite hanging. Ore is base, carrying gold and copper. Some rich ore found on the surface showing free gold. Slightly developed with a shallow shaft and a short tunnel on the vein. Idle.

Tip Top, a prospect, consists of 60 acres, in Sec. 14, T. 27 S., R. 33 E., M. D. M., in the Pioneer district, about 36 miles north of Caliente in the Sequoia Forest Reserve. Owner, C. E. Hayes, of Bakersfield. Small vein in granite. Workings consist of a tunnel on the vein 360 feet long and 200 feet of drifts. Idle.

Trestle, a prospect, owned by J. Trestle, and leased to the Practical Investment Company, of Los Angeles, W. R. Letton, president, is a small producer, in the Green Mountain district, in Sec. 18, T. 29 S., R. 34 E., M. D. M., about 26 miles northeast of Caliente, in the Sequoia Forest Reserve. Holdings consist of 60 acres, at an elevation of 7400 feet. Vein is small but high grade, granite walls. Ore is free milling. A tunnel on the vein 600 feet long and 200 feet of drifts comprise the workings. The ore is reduced in a 16-foot arrastra drive by steam power, wood being used for fuel. Four men employed.

Tropico, formerly known as Big Tree, is owned by the Tropico Minin and Milling Company, of Rosamond; V. V. Cochran, president B. Gross, secretary. The holdings consist of 80 acres in Secs. 10 11, 14 and 15, T. 9 N., R. 13 W., S. B. M., about 5 miles northwest o Rosamond, at an elevation of 2500 feet. The vein is 2 feet wide, strik northeast and southwest, dip 45° S., quartz-porphyry walls. Workings consist of a shaft 300 feet deep, 2000 feet of drifts and a stop 160 feet long. Mine equipment consists of a gasoline hoist, cars, sho ore bins and dwellings. Reduction equipment consists of a 10-stam mill, Blake crusher and cyanide plant. Gasoline used for power. Idl

Urbana and Frank, consist of 24 acres, patented in 1882, in Se 28, T. 25 S., R. 33 E., M. D. M., in the Cove district, about ¾ of a mil north of Kernville in the Sequoia Forest Reserve. Owners, Kern D velopment Company, of Portland, Maine. C. S. Long, president and manager, Kernville. The vein has an average width of 18 inches, granite walls, strike S. 75° W., dip 70° N. Pay shoot is 700 feet long and 18 inches wide, free milling and high grade. Workings consist of five shafts from 50 to 180 feet deep, drifts and stopes. Ore milled in 10-stamp mill on Kern River. Production to date $200,000. Adjoining mines: Sumner on northeast, Bull Run on southwest, Lady Belle on south, and Beauregard on northwest. Rich ore extracted by lessees years ago.

White Star, a prospect, consists of 20 acres in Sec. 11, T. 27 S., R. 32 E., M. D. M., in the Pioneer district, about 32 miles north of Caliente, in the Sequoia Forest Reserve, at an elevation of 4300 feet. Owner, F. A. Braden, of Bodfish post office. Small vein, granite foot-wall and syenite hanging. Pay shoot is 40 feet long and 10 inches wide, free milling. Slightly developed with a tunnel on the vein 320 feet ong, 400 feet of drifts and a stope 40 feet long. Reduction equipment consists of a 2-stamp mill (1000-pound stamps), steam driven, wood being used for fuel. Some rich ore mined. Property said to have produced $30,000. Idle.

Willow (placer), consists of 40 acres, in Sec. 22, T. 25 S., R. 33 E., M. D. M., in the Cove district, about ¾ of a mile north of Kernville, at n elevation of 2700 feet. Owners, Orejana Mining Company, of Hayward. C. S. Long, president and manager. River deposit, late and granite bedrock, soft. Pay gravel is about 6 feet deep. Extent of deposit not determined. Ditch has a capacity of 300 inches, he water being diverted from the Kern River. Worked several years go by ground sluicing. Idle.

Windy Gold Mining Company, controlled by John Singleton, of Randsburg, owns 90 acres in Sec. 34, T. 29 S., R. 40 E., M. D. M., in he Rand district, about ¾ of a mile west of Johannesburg, at an elevaion of 3800 feet. Property leased to Fahey Bros. Small vein in chist, high grade ore, free milling. Workings consist of a shaft 200′ eep, drifts and stopes. Equipment consists of a horse-whim, cars, hop and dwelling. Ore is shipped to the Red Dog custom mill. Ore uns from $40 to $300 per ton. Two men employed.

Winnie, consists of 20 acres in Sec. 11, T. 30 S., R. 40 E., M. D. M., bout 3 miles southwest of Johannesburg, in the Stringer district, at n elevation of 4000 feet. Owner, C. A. Koehn, of Randsburg. A umber of small parallel veins in schist. Worked by means of shafts rom 50 to 250 feet deep. Ore free milling, carrying a small percentage f tungsten. Horse-whim, shop and dwelling on the claim. Two men nployed. Two lessees working a portion of the holdings. Ore hipped to Red Dog custom mill. Small producer.

Yellow Aster, the largest gold producer in southern California, and one of the noted mines of the State, is located in Sec. 2, T. 29 S., R. 40 E., M. D. M., in the Rand mining district, about 2 miles west of Johannesburg. The holdings, consisting of over 600 acres, are owned by the Yellow Aster Mining Company, of Los Angeles; John Singleton, president; Roselle Burcham, secretary. Elevation 5200 feet. The vein has an average width of 250 feet, schist hanging-wall, footwall not exposed as yet. The country rock consists of granite, porphyry and schist. The workings consist of a shaft 750 feet deep, 12 miles of tunnels, 15 miles of raises, winzes and stopes, and a number of open cuts. Method of mining consists of open cut work, formerly by shaft and tunnels. Ore reserve about 5,000,000 tons of $3 rock. Mine equipment consists of three 7-ton Porter locomotives, 15 h.p. gas motor, machine drills, compressor plant, shops, 130 h.p. gasoline hoist and three air hoists. Reduction equipment consists of 130 stamps and cyanide plant (see photo No. 10). Steam power costs $12.50 per h.p. Electric power system being installed to connect with line of Sierra Power Company. Tailings stacked on the dump at present. About 500 tons of ore are crushed daily, free milling. Extraction about 98%. Yearly production $480,000. Production to date (1895–1914) over $8,000,000. Total mining and milling costs $1.55 per ton. Water is obtained by pumping from two springs, one at Goler, 7 miles northwest of the mine, and another 4 miles northeast; cost about 40 cents per 1000 gallons. About 20,000 b. m. feet of timber per month is required. Number of men employed 175. Monthly dividends at present $5,000. Adjoining mines: Consolidated on the east and Maginnes on the west.

Photo No. 10. New 100-stamp mill, Yellow Aster Mine.

Zenda, a producer, consists of 180 acres in Sec. 30, T. 30 S., R. 33 E., M. D. M., in the Amalie district, about 12 miles northeast of Caliente, in the Sequoia Forest Reserve, at an elevation of 3500 feet. Owner, Zenda Mining and Milling Company, of Los Angeles; Dr. C. W. Bryson, president; T. Martin, secretary. Leased to J. Faucet. Vein has an average width of 30 feet, granite footwall and quartz-porphyry hanging, strike northeast and southwest, dip 40° N. Pay shoot over 300 feet long and 30 feet wide, free milling. Workings consist of a tunnel on the vein 230 feet long and several hundred feet of drifts and stopes. Some ore extracted from open cuts. Several hundred thousand tons of ore in sight. An automatic tramway (48 buckets holding 200 pounds each), $\frac{3}{4}$ of a mile long, conveys the ore from the mine to the mill. Equipment consists of 120 h.p. Fairbanks-Morse gas engine, 20 h.p. pump, assay office, small electric plant, and dwellings. Reduction equipment consists of 10 stamps, tube mill ($4\frac{1}{4}' \times 18'$), Dorr classifier and thickener, and five cyanide tanks (daily capacity 10 ons each). New equipment cost the lessee $40,000. The pebbles for he tube mill come from San Diego and cost $25 per ton. Gasoline sed for power. Four men employed.

GYPSUM.

Gypsum deposits of varying quality occur for many miles along the ower foothills of the Sierra Nevada, reaching from Caliente on the south nearly to Porterville on the north.

In the valley of Cottonwood Creek, 5 miles north of Pampa Station, on the Southern Pacific Railroad, the beds are rather extensive, and a number of mines have been opened. The gypsum here occurs both as a crust on the surface and as interstratified beds. The latter vary in hickness from 20 inches to 5 feet, and lie upon a bed of marl. The material is sacked and hauled 8 miles to Wade Station, and is used for fertilizing purposes.

U. S. G. S. Bull. 223, p. 121.

W. A. Fauntleroy mined gypsum several years ago from his property n Secs. 21, 27, 28 and 29, T. 29 S., R. 30 E., M. D. M., on both sides of Cottonwood Creek.

Near McKittrick, in Sec. 21, T. 30 S., R. 22 E., a deposit of gypsum as been worked by the *California Gypsum and Mineral Company.* This deposit is 2 feet deep, and overlain by 6 inches of soil.

Abbott and Hickox own a deposit in Sec. 30, T. 30 S., R. 22 E., bout $2\frac{1}{2}$ miles southwest of McKittrick. Deposit that has been worked s about 500 feet long, 200 feet wide, and 12 inches thick. About 5000 ons have been shipped. The analysis of this gypsite gives an equiva-nt of 92.5% of gypsum (hydrous calcium sulphate).

There are several small areas in the vicinity of Sunset that carry thin deposits of gypsite. Large quantities are also reported in the southeastern part of Kern County.

Bibl.: Reports X, p. 223; XI, p. 233; XII, p. 324; U. S. G. S. Bull. 223, p. 121; Bull. 413, pp. 16–20.

IRON.

Deposits of iron ore occur at Woody, in Secs. 10 and 15, T. 26 S., R. 29 E., M. D. M.; at foot of Mount Breckenridge in Sec. 4, T. 29 S., and near San Emidio in Sec. 17, T. 9 N., R. 21 W., S. B. M. None of these deposits have been worked, and their commercial value is doubtful on account of the cost of transportation.

Iron Mountain, consists of 80 acres in Secs. 10 and 15, T. 26 S., R. 29 E., M. D. M., about 1½ miles south of Woody. Owned by J. Werringer of Woody. Deposit is 300 feet wide, consisting of magnetite, mica schist walls. A few open cuts constitute the development work. Some of the ore contains 70% iron.

Iron Mountain Nos. 1 and 2, consist of 40 acres at the foot of Mount Breckenridge, in Sec. 4, T. 29 S., R. 31 E., M. D. M., about 20 miles north of Caliente. Formerly owned by D. Lutz, of Bakersfield. Deposit consists of hematite from 10 to 300 feet wide, mica walls, strike northeast and southwest, dip 45° W. A few open cuts constitute the development work.

Two to One, located in Sec. 17, T. 19 N., R. 21 W., S. B. M., owned by C. R. Merriam, of Bakersfield. Consists of a massive deposit of hematite from 50 to 400 feet in width. Slightly developed by means of open cuts and short tunnels.

LIME AND LIMESTONE.

The lime industry is a large and important one at Tehachapi, on the Southern Pacific and Santa Fe railroads. The industry began several years ago by burning lime for local use, and then for shipment to other points, until now the Tehachapi lime is known all over southern California.

Limestone outcrops at many points in this area, also at Keene, and along Erskine Creek, some 30 miles north of Caliente (see photo No. 11.)

Jameson Lime Company owns an extensive deposit of limestone in the west half of Sec. 14, T. 32 S., R. 33 E., M. D. M., about 2 miles east of Tehachapi. These holdings, consisting of 320 acres, are controlled by J. W. Jameson, of Taft, and an excellent grade of lime is produced. The limestone is in part coarsely crystallized, and blue to white in color. The belt is at least 2500 feet wide and several hundred feet

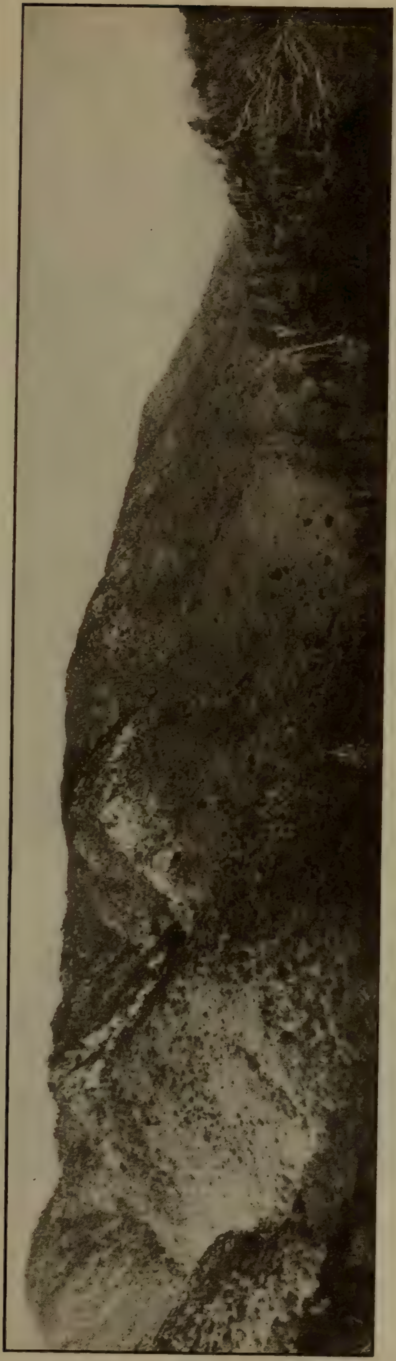

Photo No. 11. Limestone croppings along Erskine Creek.

thick, with practically no overburden. The deposit has been worked for twenty years. Limestone is burned in two modern kilns, having a daily capacity of 40 barrels each. Oil is used for fuel, costing 50¢ per barrel. Plant is operated about six months during the year, ten men being employed.

Bibl.: Bull. No. 38, p. 70. The Structural and Industrial Materials of California, issued by California State Mining Bureau.

Mountain Summit Lime Company, of Los Angeles, owns a large limestone quarry at Keene Station, 8 miles northwest of Tehachapi, and some years ago considerable lime was produced. Lime is similar to the Tehachapi product.

Summit Lime Company, formerly known as the Union Lime Company, owns 640 acres, patented in Sec. 35, T. 12 N., R. 15 W., S. B. M., about 3 miles south of Tehachapi. F. O. Wyman, president; W. O. North, secretary; C. W. Shoff, superintendent; Home office, 303 Heney Building, Los Angeles. Trade name, "Blue Summit Lime." The limestone occurs in heavy beds, with a strike of N. 75° W., and varies in color from white to light blue. It is all crystallized, in some places coarse grained, and elsewhere fine grained. The quarry is 300 feet long and 300 feet deep, the rock being conveyed to the kilns by an automatic tram. The company operates four kilns at the deposit, and four

Photo No. 12. Summit Lime Company's Plant at Tehachapi.

near Tehachapi, in Sec. 21, T. 32 S., R. 33 E., M. D. M. (see photo No. 12). The limestone is hauled from the quarry to the Tehachapi plant, 3 miles, with eight-horse teams. Total capacity of the two plants is 560 barrels. Oil used for fuel. Output in 1912 was 120,000 barrels. Fifty men employed. Product sold in southern California and in Arizona.

Bibl.: Report XIII, p. 628; Bull. No. 38, p. 71.

MACADAM.

Kern County Rock Quarry, located in Sec. 21, T. 31 S., R. 32 E., M. D. M., at Keene Station, is owned by the county of Kern, and comprises an area of 100 acres, patented. The deposit is a rather coarse-grained, friable granite, which it is proposed to crush and use as macadam on the county roads. Such rock, however, is a poor road-making material. A large crushing plant, to be operated by electricity, is being installed. Twenty men employed.

MAGNESITE.

Bissell Deposit is unique in being the only occurrence of magnesite of evidently sedimentary origin that has been reported in the United States. These holdings, consisting of 40 acres, are located in Secs. 11 and 12, T. 10 N., R. 11 W., S. B. M., about $\frac{3}{4}$ of a mile north of Bissell Station, on the Atchison, Topeka and Santa Fe Railroad, 11 miles east of Mojave. Located in 1907 by B. M. Denison et al., of Tehachapi. The magnesite occurs in definitely bedded form, interstratified with clay and clay shales, the whole having a width of some 300 feet, and can be traced for a distance of 2500 feet. The workings consist of open cuts and shallow shafts from 10′ to 30′ deep.*

Section at prospect cut near Bissell Station shows:

	Feet	Inches
Magnesite		4
Clay, thin streak		
Magnesite		2
Clay, thin streak		
Magnesite		2
Clay (with thin streak of magnesite)		6
Magnesite		8
Clay, greenish	1	3
Magnesite		2
Clay, greenish	1	
Totals	4	3

(Bull. No. 540, p. 515, U. S. Geol. Surv.)

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*Shipments are being made (May, 1915) to the calcining plant of the Rex Plaster Co., at Los Angeles.

Analyses of samples of magnesite from Bissell.

	1	2	3	4
SiO_2	9.64	8.51	6.03	4.75
$Al_2O_3+Fe_2O_3$	2.46	2.94	1.40	.76
CaO	4.25	3.36	1.56	Trace
MgO	37.19	38.32	42.78	44.20
CO_2	40.70	40.12	45.78	47.32
Undetermined	5.76	6.75	2.45	2.97
Totals	100.00	100.00	100.00	100.00

Theoretically pure magnesite is composed of 47.6% of magnesia plus 52.4% of carbon dioxide.

Bibl.: Bull. No. 540, pp. 512–516, U. S. Geol. Surv.

MARBLE.

Marble occurs near Neenach, on the south slope of the Tehachapi range, in Brights Valley, in San Emigdio Canyon, and along Erskine Creek. The Neenach deposit is the only one that has been worked.

Antelope Valley Marble Quarry, owned by the Southern California Marble Company, is located in Sec. 2, T. 9 N., R. 17 W., S. B. M., near Neenach, on the south slope of the Tehachapi range. The deposit consists of a large body of fine-grained marble, consisting of a number of beds of various colors, dipping at an angle of 35° into the mountain. In the quarry is found white marble with reddish-brown and heavy blue veins. This marble has been used in the Stimson Block, Los Angeles, in the Spreckels bandstand, Golden Gate Park, Goldberg & Bowen's store, Sutter street, San Francisco. Quarry has been idle since 1904.

Bibl.: Report VI, part 1, p. 23; XIII, p. 629; Bull. No. 38, p. 100.

MINERAL SPRINGS.

Kern County has a number of mineral springs, especially along the Kern River. No water on the market.

Bibl.: Water Sup. Pap. No. 338, U. S. Geol. Surv.

Air Compressor Springs, also known as Hobo, owned by U. S. Government, consist of three springs on the Kern River in Sec. 15, T. 27 S., R. 32 E., M. D. M., about 3 miles west of Bodfish post office. Waters contain sulphuretted hydrogen; temperature 140° F.; said to be good for rheumatism. A number of people visit the springs during the summer months. No accommodations.

Delonagha Hot Springs, owned by H. H. Fish, of Bakersfield, consist of three springs in Sec. 26, T. 27 S., R. 31 E., M. D. M., about 34 miles north of Caliente, at an elevation of 2500 feet. Water contains iron, sodium and other salts; temperature 116° F.; said to be good for rheumatism. Accommodations for a small number of people.

Democrat Springs, owned by D. D. Hill, of Bakersfield, consist of five springs in Sec. 5, T. 28 S., R. 31 E., M. D. M., about 35 miles north of Bakersfield, at an elevation of 2250 feet. Auto stage conveys guests from Bakersfield to the springs. Water contains iron, sodium and other salts; temperature 115° F. Several buildings afford accommodations for a number of people.

Kernville Hot Springs, owned by A. Brown Company, of Kernville, consist of two springs in Sec. 34, T. 25 S., R. 33 E., M. D. M., on the Kern River, 2 miles northeast of Kernville, at an elevation of 2700 feet. Water contains iron and salts that are a curative for blood diseases; temperature 100° F. No accommodations.

Koehn Springs consist of five springs in Sec. 8, T. 30 S., R. 38 E., M. D. M., about 15 miles west of Randsburg. Water contains borax and other salts. Temperature 80° F.

Neill's Hot Springs, owned by J. Neill, of Isabella, consist of three springs in Sec. 31, T. 26 S., R. 33 E., M. D. M., about 3 miles north of Isabella, at an elevation of 2500 feet. Water contains iron, sodium chloride, and other salts; temperature 130° F.; good for blood diseases. Accommodations for a few guests.

Werringer Sulphur Springs, owned by J. Werringer, of Woody, consist of six springs in Sec. 3, T. 26 S., R. 29 E., M. D. M., about ½ mile south of Woody, at an elevation of 1600 feet. Water contains sulphur and some iron. Accommodations for several people.

Willow Springs, owned by E. M. Hamilton Estate, consist of twenty-three springs in Sec. 13, T. 9 N., R. 13 W., S. B. M., about 3 miles vest of Rosamond, at an elevation of 2600 feet. Water contains sodium hloride, borates, and other salts. Well known summer resort. Accomnodations for a number of guests.

NATURAL GAS.

The production of natural gas in 1913 amounted to 7,111,237 M cubic eet, valued at $568,899. (For details see Bulletin No. 69, issued by alifornia State Mining Bureau.)

ORNAMENTAL STONES.

Sapphirine chalcedony is found at Kane Springs, in masses of a deep ky-blue color, with the grape-cluster surface characteristic of this naterial. Undeveloped; extent not determined.

This stone was highly valued in ancient times and was a favorite mateial for the carved Babylonian seals, 3000 to 4000 B. C. That used for his purpose came from Persia.

Bibl.: Bull. 37, p. 73.

Rose quartz and opal reported in Kern County, north of Kernville, y J. W. Stockton, of Wasco.

PETROLEUM.

Kern produces more petroleum than any other county in California, and over 58% of the total yield of the state.

Production in 1913 amounted to 58,698,432 barrels, valued at $27,038,474. (For details see Bulletin No. 69, issued by California State Mining Bureau.)

SANDSTONE.

A large quantity of sandstone is found a few miles south of Tehachapi, and in San Emigdio Canyon, the former deposit being worked several years ago by the Kern Development Syndicate.

Kern Development Syndicate Quarry, owned by the Kern Development Syndicate, of Los Angeles, consists of 140 acres in Sec. 14, T. 32 S., R. 34 E., M. D. M., 6 miles south of Tehachapi, and 3 miles from Erie Station, on the Southern Pacific and Santa Fe railroads. The sandstone is of many colors—green, blue, red, tan and drab. The formation lies at an angle of 10°, and varies in thickness from 3 to 30 feet. The supply seems to be unlimited. The stone used in the construction of the Pasadena library building, and the Date and Fish blocks of Los Angeles. Quarry idle.

Bibl.: Bull. 38, pp. 128 and 370.

SULPHUR.

In the Sunset oil district, on the western side of Kern County, there are deposits of sulphur which altogether cover an area of several acres. Open cuts from 10 to 15 feet deep show that these deposits are made up of both high and low grade sulphur ore, the larger part, however, consists of drift cemented with sulphur or decomposed rock or earth permeated with sulphur.

Bibl.: Bull. 3, p. 33; Bull. 38, p. 372; Reports XI, p. 233, and XII, p. 410.

TUNGSTEN.

Scheelite ($CaWO_4$), the principal tungsten mineral of the State, is found in the Amalie, Rand and Stringer districts, where it is usually gold bearing.

Bibl.: Bull. 67, p. 176.

Black Hawk Group (listed under Gold).

Gold Crown Consolidated (listed under Gold).

J. Hodgson, Care American Hotel, Howard St., San Francisco, has a deposit of tungsten ore, in the form of hübnerite. It is ½ mile from the Granite King Mine 28 miles west of Randsburg.

Monarch Tungsten Gold Mining Company (listed under Gold).

Placer Gold Company (listed under Gold).

Royal Bohn (listed under Gold).

Santa Ana Gold Mines (listed under Gold).

Sunshine (listed under Gold).

Winnie (listed under Gold).

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Bulletin No. 540, U. S. Geol. Surv. Magnesite deposits in California, pp. 512–516.
Water Supply Paper No. 338, U. S. Geol. Survey.

KINGS COUNTY.

By WALTER W. BRADLEY. Field Assistant.

Field Work in September, 1914.

Kings County was created March 22, 1893, from a part of Tulare, and in 1909 extended by annexing a portion of Fresno County, so that at the present time its area is 1257 square miles. Its outline approximates a right triangle with the vertical side on the east, bounded by Tulare County, and the hypothenuse on the northwest, bounded by Fresno. Kern County forms the base at the south, while Monterey adjoins on the southwest, cutting off the point of the angle. The most notable single geographical feature of Kings County is Tulare Lake, which has varied in the past from a condition of complete dryness to a water area of over 400 square miles. Its present area is between 30 and 40 square miles. Its water is derived from the Kings River in high flood periods, and the reason for such wide variation in superficial area is that it lies in a shallow basin with very flat-sloping sides.

With the exception of the Kettleman and Kreyenhagen Hills and the edge of the Diablo Range at its southwest corner, Kings County is almost entirely a valley county. For this reason its mineral resources are not as prominent as its agricultural interests. The value of the total recorded mineral production of the county to the end of 1913, is $219,830. To this sum, the following have contributed in the order named: Brick, quicksilver, fuller's earth, natural gas, gypsum and mineral paint. Occurrences of chromite are known but they are as yet undeveloped.

The southwestern two thirds of the county is lacking in transportation facilities, while the northeastern part has both the transcontinental line of the Santa Fe and two branch lines of the Southern Pacific Railroad.

The Associated Oil, Standard Oil and Independent Producers' Transportation companies have oil pipe lines passing through the county, but no oil has as yet been produced here in commercial quantities. The San Joaquin Light and Power Company supplies portions of the county with electricity.

KINGS COUNTY—Table of Mineral Production.

Year	Brick		Gypsum		Natural gas		Quicksilver		Miscellaneous and unapportioned	
	Thousands	Value	Tons	Value	Thousand cubic feet	Value	Flasks	Value	Kind	Value
1894										
1895										
1896										
1897										
1898	1,250	$8,450								
1899	1,650	11,550								
1900	750	5,000								
1901	1,000	5,000							Unapportioned, 1900-1909	$10,500
1902	3,500	19,000								
1903	3,400	24,200								
1904	3,100	23,300								
1905	3,400	24,000					*250	$9,000		
1906	2,800	20,000								
1907	1,000	8,000							100 tons Fuller's earth	1,000
1908	3,000	24,000	100	$400					50 tons Fuller's earth	1,000
1909	1,000	8,500	100	300	360	$360			100 tons Fuller's earth 20 tons mineral paint	2,000 100
1910	400	3,200	100	490	1,200	600	100	4,525	100 tons Fuller's earth 10 tons mineral paint	1,000 270
1911			20	100		800				
1912			50	200		1,650				
1913			100	300	1,916	575			20 tons mineral paint Other minerals	60 400
Totals	26,250	$184,200	470	$1,790		$3,985	350	$13,525	Miscellaneous	$16,330

*Flasks of 75 pounds.

Totals.

Brick	$184,200
Gypsum	1,790
Natural Gas	3,985
Quicksilver	13,525
Miscellaneous and Unapportioned	16,330
Total to end of 1913	$219,830

BRICK.

Clinker Brick Company, J. H. Burnett, Hanford, owner. This plant has been idle since 1911, and is now partly dismantled. It is at Clinker siding on the Santa Fe, 1½ miles south of Hanford. A stiff mud and wire-cutting brick machine and three field kilns were used. Power was furnished by an oil burning steam plant. All bricks for local operations are at present shipped in from points outside of the county.

Trewhitt Brickyard, Hanford, abandoned.

Bibl.: Bull. No. 38, p. 243.

CHROMITE.

Chromite float has been found in the serpentine area at the southwest corner of Kings County, near Parkfield, Monterey County, but the deposits are as yet undeveloped.

FULLER'S EARTH.

C. E. Boyd of Hanford reports a small production of both fuller's earth and gypsum from a group of claims in Sec. 13, T. 24 S., R. 17 E., in the edge of the Kreyenhagen Hills northwest of Dudley. Two men were at work a part of the year.

Tulare Lake View Group. Louis and Oscar Couch, R. E. Stevens et al., of Hanford, have located this group of five claims in Secs. 26, 35 and 36, T. 21 S., R. 17 E., in the Kettleman Hills, near the Fresno County line, southeast of Coalinga, for "gypsum, fuller's earth and phosphates." Only assessment work has been done so far.

GYPSUM.

C. E. Boyd of Hanford reports a small tonnage of gypsum produced in 1913, as well as fuller's earth, from his claims in Sec. 13, T. 24 S., R 17 E., northwest of Dudley. (See also under Fuller's Earth.)

Tulare Lake View Group (see under fuller's earth).

MINERAL PAINT.

C. E. Boyd of Hanford reports having produced a small tonnage f mineral paint in connection with fuller's earth and gypsum from laims near Dudley, in the southwestern corner of the county.

NATURAL GAS.

Natural gas is obtained from a number of artesian wells around the astern side of Tulare Lake, in T. 21 and 22 S., R. 22 E., south of orcoran and west of Angiola; also in T. 20 S., R. 20 E., near Stratton Stratford post office), on the north side of the lake. The gas is found t varying depths down to between 1000 and 1100 feet. Some of the wells yield sulphur water. The gas is utilized locally, on several of the ranches where found, for lighting and heating, and also for operating gas engines. Among those having gas wells may be mentioned the following:

Boot Bros. (see E. Workman).

L. Charles of Hanford, in Sec. 13, T. 22 S., R. 22 E., west of Angiola.

R. D. Hunter, near Corcoran, has two 2-inch bored wells, 300 to 500 feet deep, both flowing.

A. H. Johnson, in Sec. 26, T. 21 S., R. 22 E., 2 miles south of Corcoran.

O. P. Quimby, in Sec. 24, T. 22 S., R. 22 E., west of Angiola.

W. N. Stratton of Stratford, on his ranch near that place.

L. D. Tennant, P. O. box 86, Corcoran, in Sec. 14, T. 22 S., R. 22 E., west of Angiola.

Esau Workman (formerly Boot Bros.), in Sec. 25, T. 22 S., R. 22 E., west of Angiola.

Bibl.: R. XIII, p. 567; Bull. 3, pp. 20, 68; Bull. 19, p. 183.

PETROLEUM.

There are a couple of strips of possible oil-producing territory in the Kettleman and Kreyenhagen Hills, running through Kings County, between the Coalinga district of Fresno County on the northwest and the Lost Hills district of Kern County to the southeast. A number of companies are drilling in this section, but no production of oil in commercial quantities has as yet resulted. For a detailed description of the geology and possibilities of this district, see Bulletin No. 69 of the State Mining Bureau, "Petroleum Industry of California."

QUICKSILVER.

The quicksilver district of Kings County is at its extreme western end in the corner formed between Fresno and Monterey counties. It is on the eastern edge of Table Mountain which extends northwesterly through that part of Monterey and forms a portion of the boundary with Kings. Table Mountain is principally of serpentine. Parkfield, Monterey County, is the nearest town.

Dawson Pit. H. Dawson, Lemoore, owner. This is a quicksilver prospect on patented land in the NW. ¼, Sec. 28, T. 23 S., R. 16 E., near the Kings Company. Only a small amount of development work has been done.

Bibl.: Bull. No. 27, p. 122.

Fair View Group. G. H. French and J. A. Greenlaw, Parkfield, owners. In the SW. ¼, Sec. 28, T. 23 S., R. 16 E. Assessments only.

Bibl.: Bull. No. 27, p. 122.

Francis Claims (see Kings Quicksilver Mining Company).

Kings Quicksilver Mining Company, Ltd. Wm. Gray, president; W. P. Darsh, secretary; office, 520 King street, London, Ontario, Canada. A. A. Lewis, superintendent at the mine. This property includes the Segregation and Summit claims owned by C. F. Francis, under bond, besides a number of claims located by members of the company on adjoining ground. The group is principally in Sec. 20, T. 23 S., R. 16 E., 14 miles by road east of Parkfield and 40 miles north of east from San Miguel on the Coast Division of the Southern Pacific Railroad. Elevation 3100 feet (bar.) at the lower tunnel. The country rocks are serpentine, shale and metamorphic sandstone. The ore values occur in a crushed zone, in part as stockworks, carrying cinnabar and native mercury with some calcite. In the upper level this zone shows about 35 feet wide, with strike southeast and dip 45° to 50° SW., and when visited had been drifted on for 70 feet. The upper adit was in 700 feet (part crosscut and part drift), with two raises to the surface and one winze of 85 feet to the lower adit. The latter has 850 feet of work and reaches a depth of 200 feet below the outcrop. Five men were at work. Hand drills and augers are used.

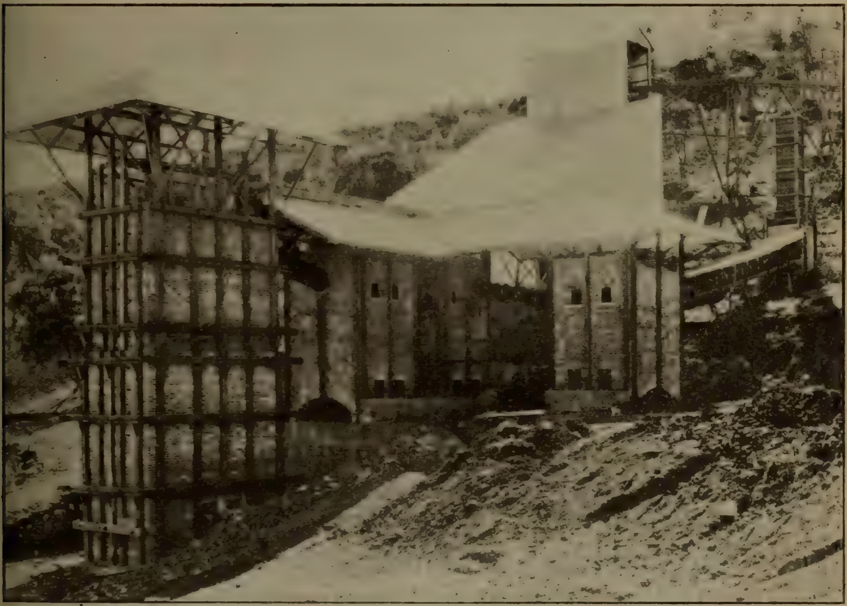


Photo No. 116. Ten-ton Scott fine-ore furnace and condensers, Kings Quicksilver Mining Company, Ltd., Kings County, California.

The mine was originally worked about 1902, and again in 1905 and 1910, during which operations it is credited with a total output valued at over $13,000. The reduction equipment consisted of a series of pipe retorts. The present company has this year completed a 10-ton Scott fine-ore furnace (see photo No. 116), with brick condensers. The bricks were burned in a field kiln at the mine. It is intended to install concentrators. These and the rock breaker will be driven by a 25 h.p. crude oil engine; and the furnace blower by a 4 h.p. distillate engine.

Bibl.: Bull. No. 27, p. 122; *U. S. G. S.*, Min. Res. 1902, p. 253; 1912, Pt. I, p. 939; 1913, Pt. I, p. 204.

Segregation and Summit (see Kings Quicksilver Mining Company).

MADERA COUNTY.

By R. P. McLAUGHLIN and WALTER W. BRADLEY, Field Assistants.

Field Work in July, 1913, and July, 1914.

Madera County, which was created March 11, 1893, has an area of 2112 square miles. It was formed from Fresno County which adjoins it on the south and west, the San Joaquin River being the boundary line between the two. On the north are Merced and Mariposa counties, with Mono on the east.

Madera County is longest—approximately 100 miles—in a northeast-southwesterly direction. The western half is in the San Joaquin Valley proper, while the eastern boundary line runs along the summit of the divide of the Sierra Nevada Mountains and possesses a number of peaks exceeding 12,000 feet in altitude. Among these may be mentioned: Mt. Lyell, 13,090 feet; Rodgers Peak, 13,056 feet; Ritter Mountain, 13,156 feet; McClure Mountain, 12,500 feet; Banner Peak, 12,957 feet; and the Minarets, 12,000 to 12,278 feet. The high Sierran section abounds in glacial lakes and meadows. The Devil's Post Pile, a knob of hexagonal, basaltic columns, which has been designated as a "National Monument" is in this part of Madera County near Mammoth Pass and the head of the Middle Fork of the San Joaquin River.

Geology.

A detailed geological survey was not made, but a general description can be given, as the relations of the formations are comparatively simple. There are several parallel belts running northwesterly across the county.

The western part of the county (the San Joaquin Valley) is nearly level and consists of sedimentary and alluvial beds lying nearly horizontal. These horizontal beds rest on steeply dipping schist which is exposed in the westerly foothills forming the eastern margin of the San Joaquin Valley.

The schist belt is 4 or 5 miles wide, its western boundary being the eastern edge of the flat floor of the San Joaquin Valley. The eastern boundary of the schist is a contact with granite or granodiorite which line runs as follows: From the western base of Green Mountain crossing the Southern Pacific Railroad about 1 mile east of Jesbel to a point near Sesame. This zone of schist contains the copper deposits of the county. It has been looked upon favorably by some people desirous of prospecting for oil, but of course no such occurrence is probable or even possible.

The granite occupies a zone from 5 to 10 miles wide, its eastern boundary being schist or slate. This line of contact runs southwest from Grub Gulch to Coarse Gold and the vicinity of Hildreth. The granite or granodiorite is usually coarse-grained and decomposed for a depth of about 20 or 30 feet. Exceptional spots exist where the rock is fine-grained and not decomposed to great depth. It is these exceptional spots which furnish the valuable deposits of building stone. Dikes are in evidence in various parts of the area standing up as ridges 40 to 50 feet wide. The dikes observed were of finer texture than the surrounding rock and possibly composed of different minerals, as muscovite was noted in some of them.

Schist and slate exist as a belt from 3 to 5 miles wide along Potter Ridge. Its eastern boundary is a contact with a large body of granite. The contact runs immediately west of Wassamma (''Poison Switch'') and near Lone Cedar Ranch. Granite dikes, from a few feet to ¼ mile wide, cut the slate and schist in many places. This is more fully illustrated with a drawing by W. H. Storms, Report of State Mineralogist, XII, 1894, p. 166. This belt of schist and slate carries most of the gold bearing veins of the county. Toward the east, into the high Sierras, most of the rock is granite, with some metamorphic areas near Mt. Raymond and around The Minarets. Within the larger granite area, occupying the eastern portion of the county, are found smaller areas of metamorphic rock, largely quartzite.

Mt. Raymond, White Chief Mountain and Iron Mountain, T. 5 S., R. 22 and 23 E., immediately east of the Mariposa Big Tree grove, are composed largely of metamorphic rocks. The most of it is quartzite which in some places shows the original bedding very much contorted. In most places, however, the rock is massive and cut by numerous fractures or cleavage planes. Granite and possibly other igneous rocks are observed occasionally as though intruded in large masses. South of the Big Trees, along the road from Summerdale (''Fish Camp'') to Mt. Raymond, basic igneous rock occurs, probably as surface flows similar to those observed farther east.

Considerable prospecting was done in the region some twenty or thirty years ago, apparently without favorable results. Recently considerable work has been done in prospecting for iron and copper. Specimens of the following minerals were collected in the district: sphalerite, pyrrhotite, magnetite, chalcopyrite, pyrite, bornite and siderite.

Geologic notes—Sierra Nevada Mountains, southwest of Mono Lake.

The following geologic observations were made during a hasty trip and are presented as of possible value to future work in the neighborhood:

At the head of Bloody Canyon midway between Sardine Lake and Walker Lake is a contact of granodiorite and metamorphic rock, the latter lying to the west. The red color of the canyon sides seems due to iron oxide from the weathered metamorphic rocks. Dikes of considerable size cut the granodiorite.

The metamorphic rock from Mono Pass to Parker Peak are mostly of a slaty nature, almost black. They dip steeply and are probably a portion of a fold formed at the time of the granite intrusion. All of the dips observed by the writer were to the west, but, according to the old State Geological Survey, farther north and west the series dips toward the east, indicating a synclinal fold. Bedding is distinct and singularly regular in strike, especially near Parker Peak, where it is N. 25° W. About ½ mile east of Mono Pass schist and conglomerate accompany the slate. Very little quartz float is observed in the débris but at Mono Pass there are several old prospect holes all apparently idle for many years. Running N. 25° W. for about 2 miles from the summit of Parker Peak is a particularly noticeable light colored bed or dike following the bedding. About 1 mile west of Parker Lake, on the north side of the canyon, is a very prominent outcrop exposed for several thousand feet and suggesting by its appearance a quartz ledge. The western edge of this metamorphic mass is clearly exposed in contact with granitic rocks and runs along the following southerly line from a point ½ mile west of Tioga Pass to a point ¼ mile east of Mammoth Peak, thence along the eastern base of Kuna Crest near the west shore of Helen Lake and about ¼ mile west of Kuna Peak. The entire region is smoothed off by glaciation. Some prospecting work was done in past years at the foot of the permanent snow bank of the slope of Kiop and Parker peaks, evidently without success.

South of Parker Peak the metamorphic series continues its western margin, being near Kiop Crest and extending to the west shore of Gem Lake and its eastern margin being somewhere to the east of the ridge from Mt. Wood to Agnew Lake. At the south shore of Alger Lake the dip is about 45° to the southwest and about 80° to the southwest near Gem Lake. One fourth mile north of Alger Lake is an exposure of quartz, about 10 feet wide and 300 feet long, upon which some prospecting has been done, otherwise but little quartz was seen.

From Gem Lake to Agnew Meadows the metamorphic series continues clearly exposed with steep western dip and uniform northwestern strike. In this region there are numerous quartz veins conforming to the bedding. The North Fork Mining District was formed here in 1878, and some prospecting work was continued until 1892 when E. B. Preston described the district (Report State Mineralogist 1892, p. 218) as showing some ten veins on the east side of the Middle Fork of San Joaquin River, within a distance of about 3000 feet across the formation, having an average width of 45 feet each, the largest being 75 feet wide and the smallest 15 feet wide. "An average assay made in the State Mining Bureau from a sample of mixed ores from the different veins gave a higher result (than $30) in—silver and (over 17 per cent) lead. Some samples from the west side veins showed a yield of 30 per cent copper and 27 ounces silver.'' The report also states that there are some nine veins on the west side of the river averaging 30 to 40 feet in width, carrying a large percentage of copper. The average sample above mentioned was not, it is learned, taken across the entire vein widths but only in its mineralized streaks. The district is now entirely idle.

The most easterly exposure of the metamorphic series in this neighborhood is at the edge of a more recent flow of basic lava which apparently forms the summit of the ridge bounding Mono and Madera counties. This line of contact runs from the south end of Gem Lake near the trail for a distance of about 3 miles; thence gradually toward the east and over the summit about 2 miles south of Deadman Pass. The western or metamorphic side of the valley is of the usual smooth glacial shape while the eastern or lava side is terraced, which brings up the question as to age of the lava as compared with the glacier.

The western margin of the metamorphic series crosses the river about ½ mile north of Soda Spring and courses about S. 25° E., thence the prevailing country rock in a southwesterly direction is granitic. Occasional patches of basaltic lava lying on the granite, are encountered on the trail to Little Jackass Meadow, as follows: One mile south of Soda Spring, at the Devil's Post Pile; on the summit between Snow Canyon and Stairway Creek; and an outcrop extends for several miles along the eastern bank of the North Fork of San Joaquin River near Sheep Crossing.

Between Devil's Post Pile and Stairway Creek there is a thin mantle (possibly 2 feet) of pumice on the granite. Fragments larger than ½ inch are seldom seen. East and south of Devil's Post Pile for a considerable distance granite appears to be the prevailing rock although Mammoth Mountain is probably metamorphic. About 2 miles southwest from Mammoth Pass are two small craters, readily distinguished in the distance by their shape and color.

The lava at Devil's Post Pile is described by Preston as being glaciated, but also showing pumice cones of very recent date. The lava near Sheep Crossing has some glacial drift resting upon it. It lies in almost horizontal terraces and the topography several miles southwest suggests an extensive flow since cut by canyons.

In the vicinity of Little Jackass Meadow there is an extensive covering of glacial drift containing mostly granitic, some metamorphic and very rarely basaltic boulders.

One mile west of Little Jackass Meadows is an exposure of metamorphic rock (fine quartzite with a little mica) striking N. 15° W. Surrounding granite is glaciated.

From Little Jackass Meadows to Yosemite Valley, by way of Fernandez and Merced passes, only granite is seen.

Resources.

As will be noted from the Table of Mineral Production (p. 111) the following have yielded commercial quantities to the end of 1913 in the order named: gold, granite, copper, silver, brick, stone industry (outside of granite for building stone) and lead. In addition to these, occurrences are known of asbestos, iron, mineral water, turquoise and zinc, though as yet no commercial production of them has been made. The iron deposits, which are among the most important in the State, will be described later.

As has already been mentioned, previous to 1893, Madera County was a part of Fresno. Of the $1,555,888 gold and the $25,657 silver credited to Fresno County in the United States Mint Reports for the years 1880 to 1892 inclusive, between 80 and 90 per cent came from that portion of its territory in the schist belt between Grub Gulch and Hildreth, for which reason, $1,350,000 and $25,000, respectively, have been added to the outputs of those two metals, bringing the total value of mineral production for Madera County properties to $5,500,677 to the end of 1913. At the present time, granite is the most important mineral product of the county in point of value, followed by copper and gold in second and third places, respectively.

A recent development, which will prove of importance to the mineral industry in the future in this section of the State, is the advent of hydroelectric power. The San Joaquin Light and Power Corporation of Fresno has a reservoir and a 25,000 horsepower plant at Crane Valley on the North Fork of the San Joaquin River. Its power lines are now serving not only a large part of Madera County, but also a considerable area in Fresno, Tulare and Kern counties to the south, and Merced, Mariposa, and Stanislaus to the north.

The canal systems of Madera County, while they serve mainly for irrigation purposes, are yet worthy of mention here. The Madera Canal and Irrigation Company has more than 100 miles of ditches, distributing water principally from the Fresno River, and also from the San Joaquin River. In addition to the canals, water for irrigation is also obtained from artesian wells and by pumping. The Madera Sugar Pine Company has a 65-mile ''V'' flume (see photos No. 24 and No. 22), by which the sawed lumber is transported from its mill at Sugar Pine to the finishing mill and storage yards at Madera. In a busy season 350,000 feet b. m. are thus brought down per day, from eleven to twelve hours being required for the lumber to travel the 65 miles. The cost is but a fraction of what it would be by teams, as there is no railroad into that section.

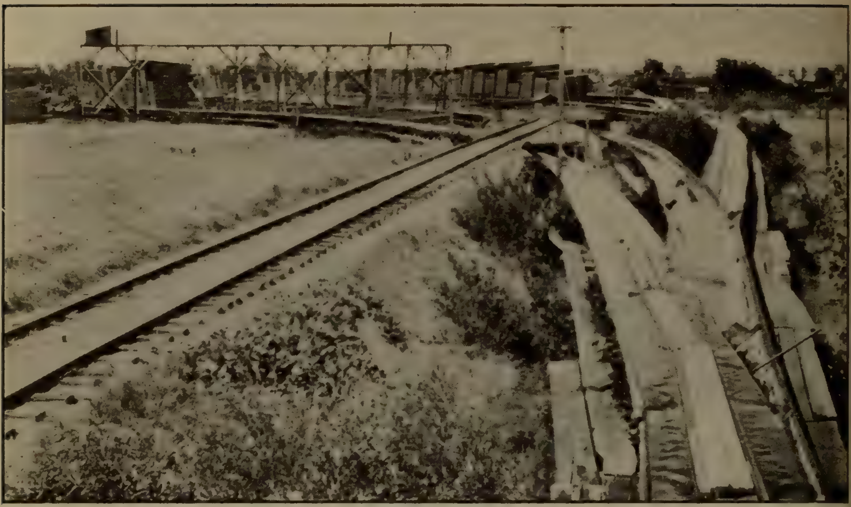


Photo No. 24. "V" Flume for transporting lumber, Madera Sugar Pine Company, Madera County, California.

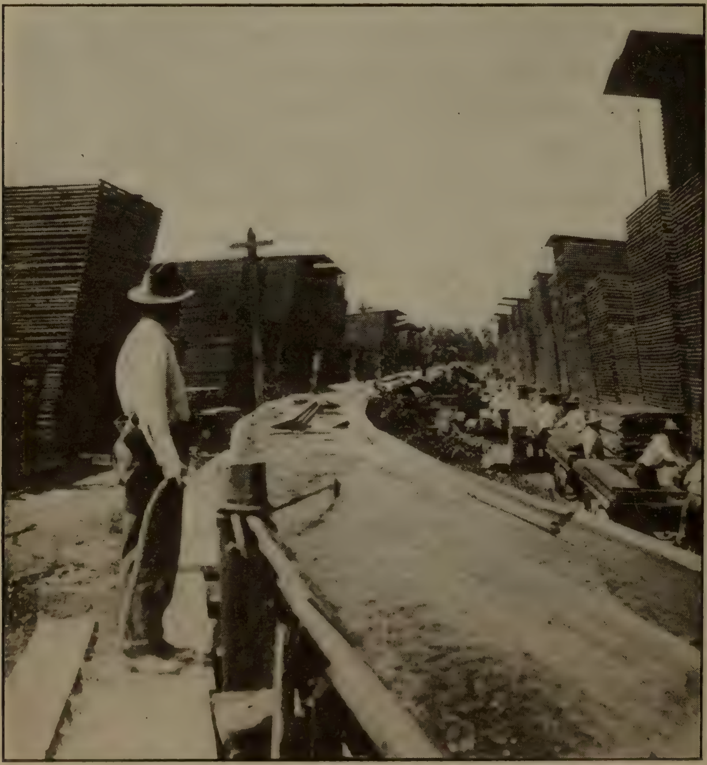


Photo No. 22. Discharging lumber from "V" flume, Madera Sugar Pine Company, Madera County, California.

Year	Gold	Silver	Copper		Brick		Stone industry				Miscellaneous and unapportioned	
							Granite		Rubble and crushed rock			
	Value	Value	Pounds	Value	M.	Value	Cubic feet	Value	Tons	Value	Kind	Value
1893	$150,696	$314										
1894	107,791	180	----	----	----	----	48,858	$31,494				
1895	162,323	----	----	----	----	----	39,590	49,662				
1896	104,339	1,240	----	----	----	----	48,628	73,525	15,600	$7,800		
1897	85,963	----	----	----	----	----	39,030	37,215	3,996	1,249		
1898	94,884	50	----	----	400	$2,800	23,103	49,673	2,940	500		
1899	73,758	292	----	----	439	3,070	47,433	36,000	5,000	2,500		
1900	104,134	3,833	500,000	$77,500	500	3,000	124,015	80,000	----	----	1900-1909, unapportioned	$65,000
1901	82,749	2,600	108,430	17,077	500	3,000	96,716	294,799	2,400	600		
1902	35,128	3	18,600	2,139	230	1,840	105,845	78,041	10,000	4,000		
1903	93,070	3	36,000	4,680	216	972	128,581	389,800	4,000	1,000		
1904	75,303	25	10,300	1,313	750	3,750	113,627	98,083	1,000	500		
1905	50,867	10,014	----	----	----	----	42,316	123,106				
1906	22,390	508	----	----	----	----	65,472	176,416				
1907	13,303	506	1,895	379	1,250	12,500	99,278	93,372				
1908	45,107	1,264	113,293	15,454	250	2,250	140,086	123,668	8,560	2,140	2,279 lbs. lead	84
1909	14,716	403	5,000	635	----	----	142,622	111,380	182,177	5,836		
1910	10,076	1,850	336,667	42,876	740	3,700	99,192	74,152	2,550	1,112		
1911	1,958	77	14,608	1,826	270	1,350	99,900	74,190	1,300	800		
1912	9,162	1,162	248,129	40,941	300	1,500	82,135	56,058	12,851	3,213	5,533 lbs. lead	249
1913	14,489	1,617	532,403	82,522	315	1,650	150,994	270,123	7,380	1,466		
	$1,352,206 *1,350,000	$25,941 *25,000	1,925,325	$287,342	6,160	$41,382	1,737,421	$2,320,757	259,754	$32,716		$65,333
	$2,702,206	$50,941										

*80 to 90 per cent of amounts credited to Fresno County, 1880 to 1892, inclusive.

Totals.

Gold	$2,702,206
Silver	50,941
Copper	287,341
Brick	41,382
Granite	2,320,757
Rubble and crushed rock	32,716
Miscellaneous	65,333
Total	$5,500,677

ASBESTOS.

Amphibole asbestos occurs at the Savannah mine, near Grub Gulch, stated to be 4 feet wide and traceable over a distance of about 3 miles in length. It is undeveloped. The amphibole variety is also found at the Baker mine near Coarse Gold.

BRICK.

Sunset Brick Company (also known as the Dyer Brickyard). J. A. Dyer, Madera, owner; bonded to W. J. Keys. This plant at the south edge of town (Madera) is operated only intermittently according to demands of the local market. The clay is hauled in dump carts to the grinders, and a soft mud brick machine is used. The bricks are dried in the sun and burned in field kilns, using oil for fuel. Electric power is used, and when operating, from eleven to fifteen men are employed.

Bibl.: Bull. 38, p. 249.

COBALT (see under Nickel).

COPPER.

The foothill copper belt of the eastern side of the San Joaquin Valley extends in a southeasterly direction through Madera County and on into Fresno. It passes to the west of Raymond a few miles, and maintains the same characteristics which it shows farther north in Mariposa County. During the copper excitement of the early sixties the Buchanan mine near the Mariposa line in Sec. 33, T. 8 S., R. 18 E., was operated with a small furnace and is credited with having shipped 150 tons of copper bars up to 1866. At various times since, work has been done on that and a number of other properties in this section, but at present only one is yielding any copper—the Daulton.

Copper ores are also found in the Minarets section of Madera County in the high Sierras, but on account of its inaccessibility from transportation lines no production has as yet been made.

Bibl.: R. XI, pp. 218–223, XIII, p. 59, Bull. 50, pp. 269–276; MINERAL RESOURCES WEST OF ROCKY MOUNTAINS, 1868, pp. 174–213; 1872, p. 47.

Daulton Mine (formerly the California Copper Company, also Ne Plus Ultra). Walter Smith and L. M. Bradford, Madera, owners. This property is in Secs. 25 and 35, T. 9 S., R. 18 E., about 1 mile from Daulton Station on the Raymond branch of the Southern Pacific Railroad. It was first worked in the sixties and the ore shipped to Swansea, Wales. There have been no changes in the equipment since that described in Bulletin 50. There are three shafts, equipped with steam hoists. The present owners are working in a limited way, with four men, and shipping an occasional carload of ore to one or the other of the large smelters of the State.

Bibl.: Bull. 38, pp. 272–275.

Yosemite Copper Company (see under Iron).

GEMS.

Specimens of *turquoise* have been found at the Taylor ranch on the Chowchilla River, north of Madera; *garnets* at Grub Gulch and Fresno Flats; and *andalusite* on the Chowchilla River, north of Madera; but no commercial production has ever resulted.

Bibl.: Bull. 37, pp. 52, 107; Bull. 67, pp. 121, 128, 163; GEOLOGICAL RECONNAISSANCE IN CALIFORNIA, W. P. Blake, 1858, pp. 304–306.

GOLD.

Gold mining is at present not active in Madera County, although a great many prospects have been opened during the past thirty years. Only three mines (Enterprise, Gambetta, and Texas Flat) have been operated extensively of recent years, and are here described. Many mines or prospects mentioned in previous reports have lost their identity either by abandonment or consolidation. An effort has been made to here record all those which have received any appreciable attention or development.

Abby. Idle for many years; Sec. 30, T. 9 S., R. 22 E., patented; owner, James Ryan. It is reported to have produced considerable gold (see Bibliography). Vein strikes N. 10° E., dips 26° NW. Incline shaft 725 feet deep. Six levels ran north from 600 to 900 feet from the shaft and a short distance south. Stoping was carried on from all the levels, the vein being from 18 inches to 2 feet wide. Ten stamps and four Frue vanners constituted the milling equipment with a capacity of 42 to 48 tons per twenty-four hours. Reported value of ore is $20, with 2 per cent sulphurets, valued at $200 per ton. About 30,000 gallons of water were pumped in twenty-four hours.

Bibl.: R. VI, Pt. 2, p. 43; VIII, p. 202; X, p. 194; XII, p. 154; XIII, p. 205.

Ackers. One mile southwest of the Waterloo mine. Owner, Otto Ackers. Two-stamp mill run occasionally.

Baker Gold Mining Company (formerly Babby). T. S. Spaulding, Woodland, president; S. H. Baker, 1616 Eleventh street, Sacramento, manager. This group of two claims is in Secs. 24 and 30, T. 7 S.,

R. 20 and 21 E., 3 miles northwest from Coarse Gold; elevation 2300 feet (U. S. G. S.), on a branch of Cabin Creek. The claims were worked by Babby for about twenty years, during the course of which he sank several small shafts, one of which is down 70 feet. The gold, which is said to assay $19 per ounce, occurs crystallized, in quartz seams in the schist. The present company took over the claims in January, 1914, and is driving a crosscut tunnel to cut the ledge at 75 feet below the outcrop. In July it was in 250 feet.

Balfron (formerly Grand Central, Sunshine and Standard No. 2). One mile northeast of Coarse Gold, in Greaser Gulch, SE¼, Sec. 32, T. 7 S., R. 21 E.; owner, C. Melvin; unpatented; only assessment work done. Located seven years ago, but known and located for many years before. Present work on 6 to 12-inch vein opened by about 200 feet of cuts and shallow adits, with ore bearing considerable free gold. Alongside is a 3-foot vein of white quartz striking N. 70° W., dipping 70° NE.; country rock, schist.

Bibl.: R. XII, p. 164; XIII, p. 213.

Bazinet Group (formerly Morrow; includes Eliza Jane, Lawsuit, and Delia). Jas. Ryan and Pete Bazinet, owners. Near the Abbey mine at Hildreth, Sec. 30, T. 9 S., R. 22 E. The property has not been worked recently and the 5-stamp mill was removed. Vein width from 12 to 20 feet, and is said to have milled less than $10. A shaft about 270 feet in depth was sunk and several adits run.

Bibl.: R. X, p. 195; XII, pp. 154, 156, 159; XIII, pp. 206, 207, 210, 211.

Belle. Southern extension of Lucky Bill claim, Sec. 12 or 13, T. 7 S., R. 20 E., unpatented, prospect with shallow surface workings; ledge not developed. Owners, O. Bentley et al., Grub Gulch.

Big Stick. Unpatented claim on Quartz Mountain, near O'Neals; no equipment; 30-foot shaft on 2-foot vein; owner, W. H. Larew, Madera.

Boomer. Prospect, unpatented, near Grub Gulch; two shafts 60 and 80 feet deep; owner, Nels Anderson.

Butterfly. Near Grub Gulch, Sec. 23, T. 7 S., R. 20 E. Three unpatented claims (Butterfly, Bumble Bee, and Sunset). Owned by Mark Sullivan of Grub Gulch. Discovered in 1883; country rock, granite and schist; vein 18 inches to 4 feet wide; coarse N. 50° W., dip 50° NE. Recently several men have been employed on development work which is as follows: On the Butterfly claim four adits on vein. No. 1, 150 feet long with 200 feet of drifting and a 98-foot winze; No. 2, 500 feet long, 100 feet of drifts and 40-foot winze; No. 3, 160 feet long; No. 4, 200 feet long. On the Bumble Bee surface cuts. On the Contact, adit 300 feet long and 160 feet of drifting.

Bibl.: R. XII, p. 155; XIII, p. 206.

Caledonia. Situated 5 miles east of Grub Gulch. Recently relocated by O. B. Allen et al. Discovered 1895. Vein 12 inches wide in schist. Adit 350 feet, shaft 30 feet, drifts 40 feet.

Bibl.: R. XIII, p. 206.

Canary (Rex). Near Grub Gulch, on Bullion and Rex veins, patented. Owner, John Day, Grub Gulch. Bullion vein 3 to 18 inches wide, course N. 60° W., in schist; 1400-foot adit on ledge (into Jeff Davis claim). About 750 feet from the entrance, crosscut runs north 200 feet to the Rex vein upon which there are: 400-foot drift west and 100 feet east, besides a 100-foot winze and raise to the surface. A 2-stamp, triple discharge mill without concentrators and operated by a gasoline engine comprises the equipment. The reason stated for inactivity is ack of water.

Bibl.: R. XIII, p. 206.

Colorado. Two miles east of Coarse Gold, prospect only slightly leveloped. Owner, J. P. Lang.

Bibl.: R. XII, p. 155; XIII, p. 207.

Consolidated Four (see Waterloo).

Contention (see Bazinet).

Crystal Spring. About 2½ miles northeast of Grub Gulch. Five patented claims idle for many years. Owner, Wales L. Palmer, Golden State and Miners' Iron Works, San Francisco. Vein 2 feet wide in chist. Several old shafts 50 to 175 feet deep.

Bibl.: R. XII, p. 155, XIII, p. 207.

Daisy (formerly Handy Andy). Near Grub Gulch, on same vein as Canary, between Rex and Woodland, unpatented. Owner, John Day, Grub Gulch. There is a 500-foot crosscut adit and a 30-foot drift. Assessment work only.

Daisy Bell (formerly Greaser Gulch). Near Coarse Gold. Adjoins Hawkeye on the northwest. Owner, Tom Jones, Jr. Discovered about wenty-five years ago. A shaft has been sunk 100 feet and at one time ich rock was worked in an arrastra.

Bibl.: R. XIII, p. 208.

Diana. Four miles south of Hildreth; Sec. 18, T. 10 S., R. 22 E., No work besides assessment. Several adits from 200 to 400 feet long. wner, John McDonald, Friant.

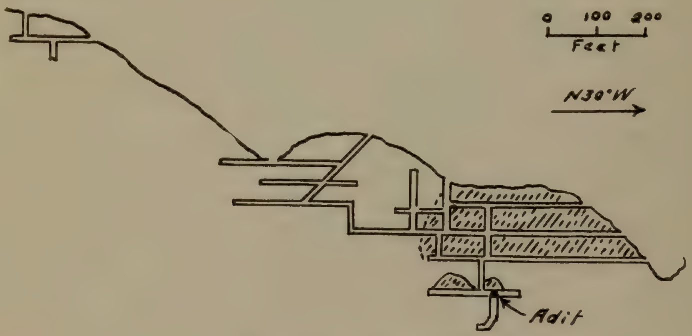
Bibl.: R. XII, p. 156; XIII, p. 207.

Eliza Jane. Prospect, included in Bazinet Group, possibly on extension of Bazinet vein. Sec. 25, T. 9 S., R. 21 E. Only work for many years is assessment.

Empire. Three miles southwest of Grub Gulch, patented. Owners, Lovely Bros. Narrow vein in granite. Worked part of time by arrastra.

Bibl.: R. XIII, p. 207.

Enterprise (one time called Fresno Enterprise). Situated in Sec. 12, T. 7 S., R. 20 E., about 3 miles northeast of Grub Gulch. Comprises 550 acres of patented land, including John W. Cates mine. Owner, Madera Enterprise Mines and Land Company, Lou R. Johnston, manager. The vein is in the bedding of schist or slate striking N. 35° W., dipping 80° NE. It is cut but not displaced by several granitic sills 2 to 3 feet thick, lying nearly horizontal. These are said to cause a slight enrichment on each side. The vein was discovered in 1881; development work, as shown on the accompanying sketch, was done within a short time after discovery and the property was idle until April, 1913.



ENTERPRISE MINE.
(From old drawing)

A 10-stamp mill, which once stood on the property, crushed, from June 1, 1881, to June 1, 1882, 8,257 tons, yielding $108,420 of bullion, assaying $19.05 per ounce, or an average value for the ore of $13.13 per ton. The present operators have erected a new 10-stamp mill, with 4-foot plates and no concentrators. A recent run of 1200 tons is stated to have recovered $13.65 per ton. Ten men were at work in July. Water from the Fresno River furnishes power except in the dry season when a gasoline engine is used. A turbine water wheel is used, operating under a 34-foot head with 650 cubic feet per minute. The stamps operate on a 6-inch drop with 7½-inch discharge and 96 drops per minute. Screens of 60-mesh are used. Capacity 18 to 24 tons per twenty-four hours. High water in January, 1914, took out the dam and flume on the river, causing considerable delay before they could be restored. There are 1½ miles of ditch and flume. A compressor running three drills is the mine equipment. All work is carried on through an adit.

Bibl.: R. XII, p. 156; XIII, p. 208.

Europa. Near Raymond. H. G. Kohlo and E. J. Harrah, Raymond, owners. Assessment work only maintained.

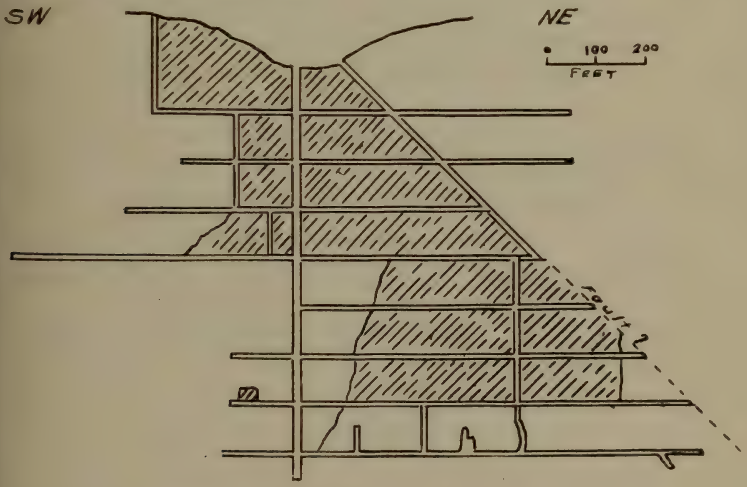
Bibl.: R. XIII, p. 207.

Five Oaks (includes Alpha). Situated 1 mile south of Coarse Gold, Sec. 9, T. 8 S., R. 21 E., on what is said to be an extension of the Waterloo vein, 3' feet wide, dipping 35° NE. Unpatented. Owner, John Quadt, San Francisco, and J. P. McFarland, Coarse Gold. Only assessment work has been done for some five years. An adit was run about 1000 feet and stoping carried up to the surface, about 200 feet. Equipment is a steam hoist and a 25-ton Huntington mill.

Bibl.: R. XII, p. 156; XIII, p. 208.

Flying Dutchman (see Hoboken).

Freda. Near Grub Gulch, adjoins the Gambetta. Unpatented. Owner, D. Ramsden, Grub Gulch. An adit 40 feet long and two shafts 20 and 25 feet constitute the development. Small production has been made from panning rich ore.



Gambetta Mine
(From Descriptions)

Gambetta (one time known as Arkansas Traveler). Situated ¼ mile est of Grub Gulch, in Sec. 15, T. 7 S., R. 20 E. Owned by the Madera onsolidated Mining Company, J. H. Lester, manager. The vein cuts across the bedding of slate or schist and into the adjoining granite coursing about N. 45° E., and dipping 78° SE. The accompanying sketch shows approximately the extent of old workings, as determined by descriptions. Enclosing schist strikes N. 50° W. and dips 40° NE. parallel to the contact with granite which lies to the southwest. Extension of the course of this vein and that of the Josephine, which strikes due east and west and dipping south, would intersect in the granite some 400 feet southwest of the new shaft. Croppings of both veins are traceable by holes sunk in the granite. The Flying Dutchman vein is still farther southwest.

The Gambetta was discontinuously operated from 1880 until 1904. Ore was crushed in a Huntington mill of 12 tons capacity per twenty-four hours. The total production is said to have been $490,000; ore averaging $33 per ton, and in 1903 a test run of 400 tons of old stope filling recovered $3.98 per ton, and 1700 tons of dump $2.38. Average width of vein is 2½ feet.

In 1910 the present operators sunk a 170-foot incline on the vein about 1000 feet southwest of the old shaft, drifted 250 feet southeast, partly between granite walls, and 160 feet northwest, and a shoot of high grade ore is reported. During the past year they cemented the shaft from 100 feet up, and on the 400-foot level have drifted 700 feet to get under the newer workings. They have also raised to the levels above from No. 2 shaft (the incline). No stoping has as yet been done in the new ground on the 400-foot. Except for three leasers driving an adit in the upper part of the mine, it has been idle since June 1, 1914. It is expected to resume on company account as soon as electric power is obtained.

The mill has at present two 5-foot Huntingtons and two Deister concentrators, giving an hourly capacity of 2½ tons. Water supply from the shaft (15,000 gallons per twenty-four hours) is said to be sufficient to mill only about 11 tons per day. Two boilers (50 h.p. and 80 h.p.) furnish power, oil fuel being used at a cost of $1.80 to $2.15 per barrel at the mine, depending upon the condition of the road from Raymond. It is expected that the San Joaquin Light and Power Company will enter the district with a line this year. A Norwalk compressor runs five 2¼-inch drills.

Bibl.: R. X. pp. 197–198; XIII, p. 208.

Golden Road (formerly Providence and County View). Possibly the north extension of Texas Flat vein. Four unpatented claims owned by C. Melvin, Coarse Gold. Adit 1300 feet long and three shafts 100, 200 and 300 feet deep. Average width of vein 5 feet.

Bibl.: R. VIII, p. 213.

Gold Metal and Gold Metal No. 1. Near O'Neal's. Mrs. Mary Arciniaga, Gilroy, owner. Assessment work only is done.

Hanmore (Lignus Asbestos). At Grub Gulch, unpatented, prospect. John Day, Grub Gulch, owner.

Hanover. Near O'Neal's, unpatented. Owner, George Williams, O'Neals. The vein is 20 inches wide and recently has been successfully worked in a small way for pockets. There is a 300-foot shaft and numerous short adits. A 5-stamp mill once stood on the property but was recently removed to a nearby claim.

Bibl.: R. VIII, pp. 204, 205; XII, p. 157; XIII, p. 208.

Hawkeye. Two miles northeast of Coarse Gold. Owner, J. P. Lang. Little work has been done recently. Two adits were run 250 and 350 feet long. A 5-stamp mill was at one time on the property, which is said to have produced about $25,000 from ore averaging $13 per ton.

Bibl.: R. XII, p. 157; XIII, p. 208.

Hazel. It is on the Fresno River near Raymond, and owned by A. C. Shaw of Raymond. Assessments only.

High Grade (formerly Washington). Two miles northeast of Coarse Gold in Deadwood Gulch, owner, Dan Long. Prospect on 2-foot quartz vein; shaft 26 feet deep. Small amount (20 tons) of ore recently milled at Texas Flat mill.

Hoboken (includes the Flying Dutchman). Situated 2 miles south of Grub Gulch (about Sec. 26, T. 7 S., R. 20 E.). Consists of ten unpatented claims, including the Flying Dutchman. Owners, Rice and Whittlesey, of San Francisco. A shaft and adit develop the ledge which is from 4 to 6 feet wide. About thirteen years ago some 400 tons of ore are said to have been put through a Bryan mill, at that time located on the property, and yielded $12 per ton. Assessment work has been done for a considerable time.

Bibl.: R. VIII, p. 213; XII, p. 158; XIII, pp. 208, 209.

J. M. Near Grub Gulch, unpatented claim, between Jeff Davis and Mammoth claims. Only workings are surface cuts. Owner, John Day. Abandoned.

Johnny. Near O'Neals, on Quartz Mountain, Sec. 4, T. 9 S., R. 21 E., portion patented. Owners, J. C. Albee and Geo. Lawrenson, who began their work about seven years ago. Adit on vein 140 feet, shaft 90 feet, vein 18 inches to 11 feet wide. An arrastra is on the ground and recently a small tonnage of ore was crushed.

Johnny Bull. Situated 2 miles northeast of Grub Gulch, between the Enterprise and Lucky Bill mines. Unpatented claim; owner,

J. D. Westfall; discovered 1895. Work consists of a 40-foot shaft and adit cutting vein at a depth of 40 feet. At one time a 5-stamp mill stood on the ground. It is said that some good ore has been produced, particularly a 9-foot incline which gave a total of $600.

John W. Cates. Portion of Enterprise property. A 60-foot shaft was once sunk and ore milled at the Enterprise.

Josephine. At Grub Gulch, Sec. 15, T. 7 S., R. 20 E., opposite the Gambetta mine, three patented claims. Owner, Risdon Iron Works, San Francisco. The mine has been idle and dismantled for many years. A 20-stamp mill was once operated. Vein 2½ feet wide, dip 55° to the south, strike nearly east and west. An incline shaft was sunk 555 feet and eight levels were run. A drawing and description are in State Mineralogist's Report X (1890), p. 203. It shows two shoots pitching east, from which it would appear that above the 325-foot level some 36,000 tons of ore were stoped. It is stated that the ore averaged about $10 per ton. There was a flow of 72,000 gallons of water per twenty-four hours.

Bibl.: R. VIII, pp. 213, 214; X, pp. 202, 203; XIII, p. 209.

Lady Ellen. Adjoins the Hoboken on the east. Four claims, agricultural patent. The vein is said to be an extension of the Hoboken. Years ago considerable surface work was done, the deepest being 60 feet. Ore was packed to arrastras. It is reported that ore left on the dumps assays $12 per ton. The property is under bond to McMicken and Rowe, who expect to begin operations.

Lawsuit (see Bazinet).

Lingo. Two miles northeast of Coarse Gold, in Swede Gulch; Scott Bufford, owner. Over 500 feet of adits have been run. It is reported that about ten years ago 200 tons of ore yielded about $12 per ton.

Bibl.: R. XII, p. 159; XIII, p. 210.

Little Bullion. Adjoins the Daisy Bell on the northwest; owner, David R. Jones. Discovered about twenty-five years ago. A 40-foot shaft and surface cuts have been opened. About a year ago 70 tons of ore were milled and reported to have yielded $22 per ton. It is near Coarse Gold.

Lucky Bill. Two miles northeast of Grub Gulch, SE. ¼, Sec. 12, T. 7 S., R. 20 E. Two unpatented claims (Syndicate and Safe deposit); owners, John Morrison et al., Grub Gulch. Discovered in 1880, but for the past three years only assessment work has been done. Workings consist of a 200-foot shaft and about 200 feet of drifting. The ore is in the form of a chimney or kidney, and is said to be 20 feet wide in the lowest workings. Ore was at one time worked in a 2-stamp mill and arrastra near the Enterprise. One run of 1000 tons is reported to have averaged $16 per ton. There is no machinery on the property and workings are full of water.

Bibl.: R. XIII, p. 210.

Magnet. Three miles northeast of O'Neals; Sec. 11, T. 9 S., R. 21 E.; unpatented claim. Owned for past ten years by R. W. Walker, who works it himself a part of each year. There are two adits 300 and 150 feet long and a shaft 100 feet deep. At one time there was a 2-stamp mill on the property. The vein is 2 feet wide and is reported to be rich in spots.

Mammoth (see Woodland).

Melvin, Mountain Lily, Mary. Near Coarse Gold, lying along the west side of and parallel to the Texas Flat property. Unpatented, discovered about 1899. Owner, C. Melvin. Vein material or stringers 60 feet wide, striking north and south, spots of good ore. There are six shafts from 60 to 240 feet deep and about 300 feet of drifting.

Bibl.: R. XII, p. 161; XIII, p. 211.

McKenzie-Minturn Mine. This is a drift mine on the north bank of the San Joaquin River, in Sec. 34, T. 10 S., R. 21 E., 3 miles northeast of Friant. Owners, A. H. McKenzie and W. Minturn, 806 Grif-iths-McKenzie Building, Fresno. Both above and below this point on the south side of the river and above it on the north side, these placer gravels were worked between 1850 and 1860, the camp being known as Millerton, the county seat of Fresno County. The present workings were commenced in 1904. The ground is patented. The gravel is in an ancient river channel with a decomposed granite bedrock. The gravel, which is firm but not cemented, is 3 to 6 feet thick, and the bedrock runs about 28 feet below the surface of the ground. The channel s 5 to 6 feet higher than high-water mark of the present river, and has a different character of gravel, being coarser and made up of different rocks.

The main adit was driven in 700 feet and stoping began at the back nd, the ground being allowed to cave behind the work. The bedrock hows three channels, the one farthest back from the present river hannel carrying the best values. The gold is coarse, but without nuggets, the largest single piece found weighing only $3.20, and is stated o assay better than $19 per ounce. About 200 feet square of the 160 acres have been worked. The gravel is stated to average around $2 per ubic yard. The method of working is to stope out the gravel, fill behind with the coarse material and tram out the sand and small stuff to the sluices. Sixteen-foot sluices with Hungarian riffles are used. A 6-inch centrifugal pump driven by a 40 h.p. distillate engine furnishes water from the river. Two men are employed (August, 1914).

McLaughlin and Pearl. Situated between Johnny Bull and Enterprise mines. Two unpatented claims owned by Mrs. G. Wilson, Grub Gulch. Discovered about thirty-five years ago. There are several adits about 25 feet long, and a shaft 50 feet deep. Two years ago a little ore was hauled to Grub Gulch and milled, reported value about $20 per ton.

Millenium. Two miles west of Coarse Gold, about Sec. 1, T. 8 S., R. 20 E., unpatented. Owner, S. H. Baker. Discovery was made eight years ago and only work is a 40-foot shaft. The vein is reported 6 feet wide in granite. Work is to commence shortly.

Moonlight and Starlight. Three miles north of Enterprise mine near Crooks ranch. The starlight adjoins the Mammoth on the east, unpatented. Owner, Nels Anderson, Grub Gulch. Vein 20 inches wide in granite. Shaft 20 feet deep and 75 feet of drifting. A Huntington mill once on the property was removed two years ago.

Morning Star. Near Coarse Gold, in Deadwood Gulch. The land is now held under an agricultural patent by a Mr. Lea of Los Angeles. No work has been done for many years when several shafts 30 to 60 feet deep exposed a narrow vein.

Bibl.: R. XII, p. 161; XIII, p. 211.

Mountain View. Six miles northeast of O'Neals, Sec. 6, T. 9 S., R. 22 E. Five unpatented claims. Owner, John Davis. Only assessment work has been done for the past ten years. A number of shafts have been sunk from 50 to 100 feet in depth, and some drifts run. Arrastras and a nearby mill once treated ore reported to have yielded $23 per ton.

Bibl.: R. X, p. 198; XII, p. 161; XIII, p. 211.

Mud Springs (formerly known as Berry, also Wilson). Near O'Neals, about Sec. 26, T. 9 S., R. 21 E. Five unpatented claims. Owners, W. McKenzie Estate, and Jas. Mussel; office, Griffiths-McKenzie Building, Fresno. Average width of vein less than 2 feet. For the past two years the property has been idle, except for assessment work. It has been partly developed for more than 300 feet in depth. A Huntington mill of 20 tons capacity per day is on the property. It was formerly worked by T. Hart and J. Hoxie of Fresno, who took out $250,000. Mussel has recently found a new shoot of ore and will reopen the mine soon.

Bibl.: R. XII, p. 161; XIII, p. 211.

New Citizen (and Pure Gold). Near Coarse Gold, in Deadwood Gulch, unpatented. Owners, Marrone and MacLain of Fresno. On a vein supposed to be the same as the Balfron. Workings are 220-foot shaft, 279 feet of drifts and 39-foot crosscut. About ten years ago 200 tons were sorted and milled, reported yield being $36 per ton. Across 5 feet of formation it is said the ore will assay $4 per ton. Assessments.

Bibl.: R. XII, p. 161; XIII, p. 211.

Old Blue (or Gladiator). Six miles east of Raymond, about Sec. 33, T. 8 S., R. 20 E. Two unpatented claims. Owner, S. H. Baker, 1616 Eleventh street, Sacramento. Two veins in the granite, dip S. 35°. Reported amount of sulphurets 7 per cent. Three shafts 120, 275 and 150 feet deep and about 175 feet of drifts. Equipment consists of a 4 h.p. gasoline hoist. Until very recently from three to eight men have been employed in development work.

Paradise. About 1 mile west of Enterprise mine. Unpatented claim. Owner, Wm. Mose. Prospect only, from which owner is reported to occasionally obtain a little gold.

Patton. Two miles east of O'Neals; Sec. 22, T. 9 S., R. 21 E., unpatented. Owner, H. G. Patton of O'Neals. Some shallow workings have been opened during the past twenty years on an 18-inch vein. At one time a small amount of the ore was worked in the Standard mill.

Paymaster (see Waterloo).

Pure Gold Mining Company (Florence M). Dr. Topp of Raymond, owner. It is in Sec. 20, T 7 S., R. 21 E., about 3 miles north of Coarse Gold. Idle.

Quartz Mountain. Five miles south of Coarse Gold; Sec. 33, T. 8 S., R. 21 E. Several claims, some of which are patented. Owners, McN. Fenn, Nels & P. Anderson et al., Madera. Idle for many years. Formerly owned by a French company which vacated about 1906. The vein is up to 10 feet wide and has yielded some rich pockets. An incline was sunk for 250 feet, and a 60-stamp mill erected.

Bibl.: R. VIII, p. 210; XII, p. 162; XIII, p. 212.

Ragesdale. Seven miles southeast of Hildreth on the San Joaquin River, two unpatented claims. Until recently owned by J. W. Ragesdale of Taft; present owners, W. G. Walker, Friant, and Dr. Powers, Sanger. Several short adits were run and at one time a small mill was on the property. The present owners propose to clean out the lower adit and drive it ahead, then raise to the upper levels and stope, there being 300 feet of backs.

Savannah. One and a half miles southeast of Grub Gulch, Secs. 14, 23 and 24, T. 7 S., R. 20 E. Four unpatented claims, owned by Maxfield & Lizby, with Mark Sullivan of Grub Gulch, superintendent. There are three veins, but most of the work has been done on one which is 4 feet wide. On the Savannah No. 1 there is a 260-foot shaft and 300 feet of drifts. On the Savannah No. 2 there is a 160-foot shaft with 100 feet of drifts. On the Wide Awake is 120-foot adit and surface cuts. On the Joe claim is a 260-foot shaft with 300 feet of drifts, all of which are caved, and a new adit 200 feet long with 200 feet of drifts has been run below the old works. There is an old 10-stamp mill on the property in very poor condition from disuse. Several men have recently been employed in development work.

Bibl.: R. XII, pp. 158, 163; XIII, pp. 212, 213.

Standard. Two miles northeast of O'Neals, Sec. 14, T. 9 S., R. 21 E. Three unpatented claims. Assessment work done for owners by H. G. Patton of O'Neals. Operations ceased about eight or ten years ago. A 5-stamp mill is located about 2 miles distant on Fine Gold Creek. Workings consist of a 300-foot shaft and some drifting and stoping. The mill was operated for about six months. Width of vein 4 inches to 4 feet.

Bibl.: R. XII, p. 163; XIII, p. 213.

Starbuck (or Fine Gold). Three and one half miles northeast of O'Neals. Unpatented. Owner, F. F. Baker. Vein 6 inches wide. Shallow surface workings by the owner have furnished ore for occasional runs by arrastra.

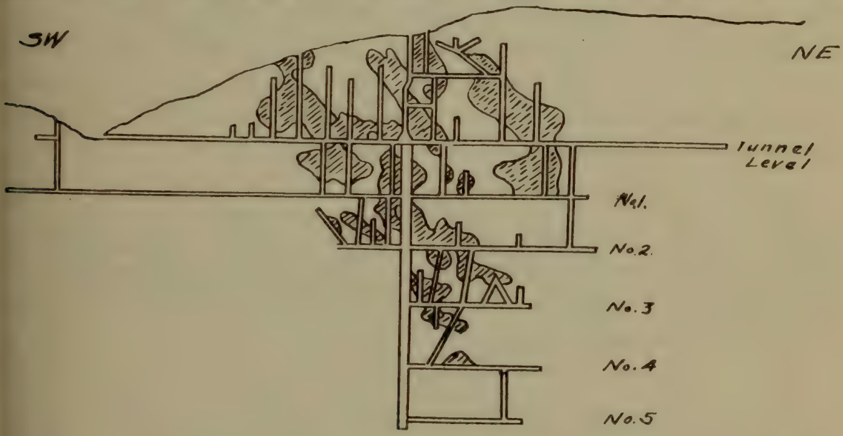
Bibl.: R. XII, p. 164; XIII, p. 213.

Starlight Group (one time called Mammoth). At Grub Gulch. Three unpatented claims owned by John Anderson. Recent work has been simply assessment. There is an old shaft; at the 50-foot level is a crosscut 150 feet north with drifts 150 feet west and 25 feet east; at the 200-foot level is a 50-foot drift west, and at the 340-foot level drifts 50 feet east and 50 feet west with a crosscut 15 feet north towards the hanging-wall. The vein outcrops for 15,000 feet or more, striking N. 70° W., dipping 45° NE. The width is 20 to 25 feet. About 1896 a 10-stamp mill was erected by an English company, the mine having been developed as above described. Operations continued only a short time.

Bibl.: R. XII, pp. 160, 162; XIII, pp. 210, 212.

Sunshine (see Balfron).

Texas Flat. Situated in Sec. 6, T. 8 S., R. 21 E., 1 mile northwest of Coarse Gold. Consists of four patented claims, discovered in 1853. Owner, Ed. Dickinson, of Kansas City. Under option to Phillip Rowe, of Seattle, who has been operating since 1912. Wm. Krohn is superintendent. The vein varies in width from $3\frac{1}{2}$ to 4 feet, strikes with the bedding of enclosing slate, N. 40° E., and dips 30° SE. An adit 1400 feet along the vein meets the 920-foot incline shaft at a point 260 feet below the collar. The workings are shown by the accompanying sketch copied from the mine map. The mine has been thoroughly equipped for about ten years. An electric power plant stands on the Fresno River about 3 miles distant. Water has 110 feet fall and generates 110 horsepower. An electric hoist is stationed at the tunnel level of the shaft. The mine is practically dry and water is ordinarily handled with skips. There is a compressor capable of running four drills. The mill has 20 stamps (1500 pounds) and 4 Wilfley tables. Capacity 120 tons per day. Since 1904 the mill operated four or five seasons from November until July when waterpower fails. In January of this year (1914) high water in the Fresno River took out their flume and damaged the power house, for which reason the mine is at present idle. Operations will be resumed, however, as soon as the San Joaquin Light and Power Company gets a line into the district.



TEXAS FLAT MINE
ON PLANE OF VEIN, DIP 30°

The total production since 1903 is said to be \$185,000, the ore averaging \$4 per ton. Amount of concentrates $\frac{1}{2}$ per cent, value \$98 per ton, bullion fineness .555. It is said that ore has been stoped and milled for \$1.40 per ton. Recent work has been on a footwall ledge at No. 3 level, where some ore of \$20 to \$50 in value is said to have been encountered.

Bibl.: R. VIII, p. 212; XII, p. 164; XIII, p. 213.

Thrower. Near O'Neal's, Sec. 9, T. 9 S., R. 21 E. Owner, Hayden Payne, of O'Neals. The vein is 2 feet wide between granite walls, and is said to average $8 per ton with rich spots. A 90-foot shaft has been sunk but only assessment work has been done recently. A small tonnage of ore is occasionally treated in an arrastra.

Ten Strike (formerly McLellan). Adjoins Hawkeye on the southeast; owner, J. P. Lang. Discovery made about twenty years ago. Vein 1 to 5 feet wide. A shaft 60 feet deep and some surface cuts have been opened. No ore has been milled. Assessments.

Topps (see Pure Gold Mining Company).

Volcano No. 1 (also called Hildreth). At Hildreth, Secs. 25 and 26, T. 9 S., R. 21 E.; patented. Owner, Wm. Dumphrey Estate. The vein is about 12 inches wide, and the last work, some twenty years ago, opened it to a depth of about 400 feet. This is the only property which has been extensively operated in the vicinity. At one time it had a steam hoist and Huntington mill and is reported to have produced about $100,000 from pockets.

Bibl.: R. XII, p. 158; XIII, p. 209.

Washington. Two miles south of Grub Gulch. Two unpatented claims; owners, John Anderson et al. The vein is 2 inches to 2 feet wide in granite. There are four shafts, 60 to 140 feet deep, and 100 feet of drifting. Assessments only at present.

Bibl.: XII, p. 164; XIII, p, 214.

Waterloo (Paymaster) *and Consolidated Four.* Four miles southeast of Coarse Gold, Sec. 15, T. 8 S., R. 21 E.; owners, H. A. Krohn et al., Coarse Gold. The Waterloo group consists of two patented claims, the Paymaster and Alpha No. 2. The Consolidated Four group is composed of four unpatented claims which adjoin the others on the northwest, all being in the same line. They are on the north fork of Fine Gold Creek, at an elevation of 2300 feet (U. S. G. S.). On the Waterloo group two parallel veins 40 feet apart strike northwest and southeast and dip 30° NE. Each vein is about 3½ feet wide and they are reported to average $10 per ton.

In 1901 an incline shaft was sunk 300 feet; an adit 400 feet long runs to the 75-foot level on the southeast side; 45 feet below the adit level a drift runs northwest 250 feet; at 90 feet below the adit drifts run southeast 150 feet and northwest 200 feet; 200 feet below the adit drifts extend each way for 200 feet. A little stoping was done and during six months' milling it is reported that $30,000 was produced. Values are principally in free gold, with some galena and pyrite. A 10-stamp steam-driven mill is on the property, unused for nine years.

The electric power line of the San Joaquin Light and Power Company now (July, 1914) crosses the property near the mill. On the lowest level a run of 300 tons is said to have averaged $8.60 per ton. Last winter high water exposed a new vein in the creek bank on the Alpha No. 2, which has been traced through the full length of both claims. It is stated that a Canadian company is now considering a bond on the property. The four unpatented claims have been opened by several shafts from 10 to 50 feet deep.

Bibl.: R. XI, p. 216; XII, p. 161; XIII, p. 211.

Willow Creek. It is 2½ miles south of O'Neals; unpatented. Owner, Chas. O'Neals. Discovered thirty years ago but only assessment work done for the past ten years. The vein is 6 inches to 5 feet wide, said to average $13 per ton by arrastra. A shaft was sunk 60 feet (now full of water) and 50 feet of drift run, besides a 90-foot adit.

Bibl.: R. XIII, p. 214.

Woodland (also known as Mammoth). Near Grub Gulch, unpatented. Owner, John Day. Adjoins the Handy Andy, on the same vein as the Daisy, known as the Bullion vein, which is 3 to 4 feet wide. An adit 140 feet long and 90 feet of crosscut. Ore said to average $5 per ton. Last winter (January, 1914) a new shoot was found, but work was stopped by heavy rains causing the ground to cave. It is intended to reopen this fall.

Bibl.: R. XII, p. 160; XIII, p. 210.

Zebra (U. B. Dam No. 1). Near O'Neals, unpatented. Owner, Wm. Rucker, San Jose. Only assessment work has been done for many years. The vein is about 18 inches wide, striking northeast and southwest and dipping 40° SE. State Mineralogist's Report, 1890, page 199, gives the following information: Four adits on the vein at vertical intervals of about 50 feet, their lengths being 640, 460, 510, and 583 feet, and a 100-foot shaft near the lowest adit. Considerable stoping was done, one shoot being developed for a length of 120 feet, and two other shoots partly determined. A Bryant roller mill of 18 tons capacity was operated for a time, but removed about fifteen years ago. Mining and milling is said to have cost $2.10 per ton; and the ore to have averaged $15 to $20 per ton.

Bibl.: R. VIII, p. 210; X, p. 199; XI, p. 216; XIII, p. 214.

Zulu. Near Coarse Gold. A prospect formerly owned by David R. Jones, now abandoned. Work consists of a 30-foot shaft and 60-foot drift, besides surface cuts. About 5 years ago 100 tons of ore were milled.

IRON.

On the western slope of Mt. Raymond, Sec. 9, T. 5 S., R. 22 E., there has been considerable prospecting in recent years for iron. Near the summit of the mountain is an adit about 50 feet long, showing irregular spots and seams of magnetite and pyrite 2 feet to 3 feet wide. The country rock is a siliceous metamorphic showing considerable red iron stain and some smaller spots of leached iron ore. Three unpatented claims (Bathse, Summit, and Blue Bell) located about twenty years ago comprise the property owned by *Thomas Biledo,* of Fresno Flat.

In the same locality, but farther south near the base of Mt. Raymond, a number of shallow shafts have been sunk by *H. A. Krohn* of Coarse Gold. Geologic conditions are similar to those on the Biledo property, except that soil covers a great deal of this land. Some bodies of magnetite and other iron ores are exposed, possibly being in the form of lenses as much as 4 or 5 feet thick and 50 to 100 feet long.

Farther east, about Secs. 14, 15, 22 and 23, T. 5 S., R. 22 E., similar geologic conditions prevail and many shallow pits and shafts have been sunk by *T. G. Hart* of Fresno.

Yosemite Copper Mines Company. George J. Main, superintendent, Hayward. This company has done considerable work at Hogum in the vicinity of Iron Creek, Sec. 14, T. 5 S., R. 22 E., and Sec. 7, T. 5 S., R. 23 E. The property consists of nine claims and a mill site which have been surveyed for patent. Five adits from 40 to 100 feet in length have been run, besides numerous smaller surface workings. On the claims in Sec. 14 six core-drill holes have been sunk from 30 to 225 feet. Geologic conditions as described nearer Mt. Raymond prevail here except that on this property there is more granite or granodiorite. The drill cores are said to show a thickness of from 50 to 100 feet of ore, which seems to be principally magnetite, white iron sulphide, and pyrite. But little copper stain from sulphide or carbonate is seen. It is stated that assays of the entire cores were not made. The cores have been preserved. Outcrops near the drill holes do not indicate a continuous ore body and lack of evidence as to dip prevents definite statements as to extent.

Some idea of hardness of the rocks may be conveyed by the rates of drilling with a Davis Calyx 3½-inch machine using chilled steel shot They are said to have averaged as follows: Granite, 6 to 10 feet per day; ore, 4 to 6 feet; quartzite, 2 to 3 feet.

Transportation facilities to the district are poor, the nearest railroad point being Raymond, about 30 miles distant. Heavy snowfall prevents work for from four to six months a year. There is a fair water supply, and excellent timber covers most of the territory.

Bibl.: R. X, pp. 191-193; XI, p. 214; Bull. 38, p. 298.

THE MINARET IRON DEPOSIT.

By F. B. WEEKS.

A reconnaissance examination, by the writer, of all reported iron leposits in California showed the largest to be in Madera County. This ron deposit occurs at the south end of the Minaret range which constitutes one of the prominent ridges of the Sierra Nevada in the north-st corner of Madera County. The region is characterized by Alpine ggedness and contains many glacial amphitheaters and lakelets. It drained by the North and Middle Forks of the San Joaquin River ich have cut canyons 3,000 to 4,000 feet below the general level of e Minaret ridge, which separates these streams. Figure A shows the pographic features of the country. This photograph was taken from

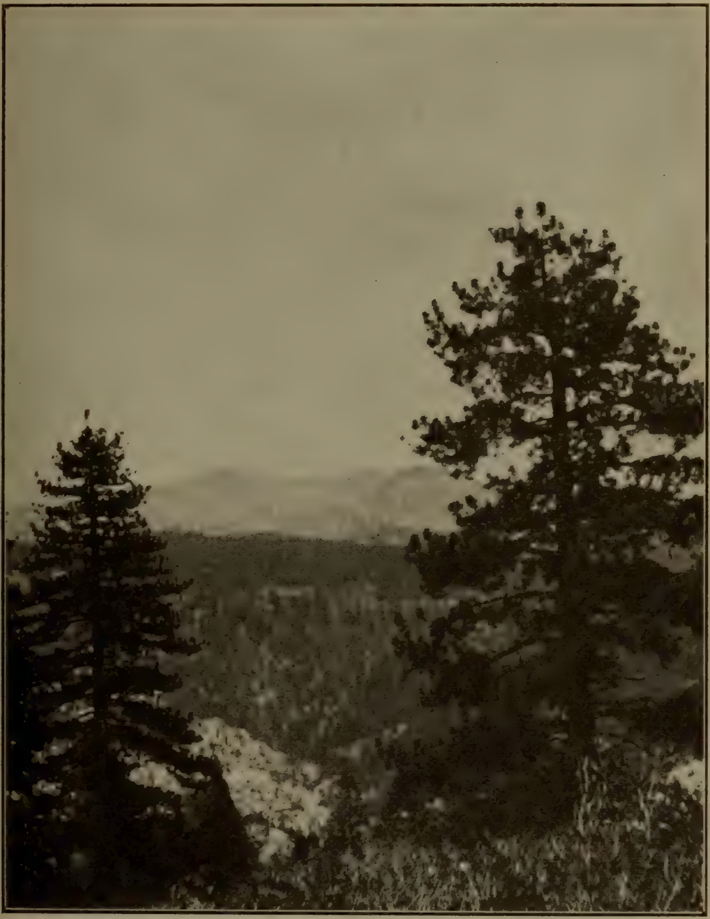


Fig. A. Southern end of The Minarets, looking from the west. Peak at left of center is Iron Mountain. Photo by F. B. Weeks.

the ridge on the west side of the North Fork looking east to the southern end of the Minaret range. The peak at the left of the center of the picture is Iron Mountain.

A mountain wagon road has been constructed from Fresno Flats to Jackass Creek and from this point there is a trail used by cattle men which crosses the North Fork on a bridge known as Sheep Crossing and thence to "77" Corral. From "77" Corral there is a trail leading north to Iron Mountain. From the east the deposit may be reached by wagon road from the town of Bishop in Owens River Valley to Mammoth, and thence by trail over Mammoth Pass and crossing the Middle Fork near the Devil's Post Pile and to "77" Corral. These roads, trails and localities are shown on the topographic maps of the U. S. Geological Survey of this region and these maps should be in the hands of every person going into this country. The only persons in the region are a few prospectors and cattle men in July, August and September. The remainder of the year the country is uninhabited. The winters are long and severe and the snowfall heavy.

There is considerable timber in the region but the iron deposit is 1500 feet or more in elevation above timber line. The North Fork would afford water power for any mining or milling operation in this region.

A preliminary railroad survey was once run through this country by way of Mammoth Pass. A railroad from the west would traverse a rolling country rising gradually to the east as far as the ridge on the west side of North Fork. From this point construction and operation of a railroad would meet with the usual difficulties encountered in the high Sierras.

This iron deposit has been known for many years. It has been briefly described, usually in exaggerated terms, in various mining papers and is mentioned in some of the reports of the California State Mining Bureau. It should be remembered that it has only been within a few years that the nature and origin of iron deposits of this character hav been sufficiently understood to expect a reasonable description from persons who have personally examined this deposit.

From "77" Corral up the trail to the foot of Iron Mountain th country rock is the grano-diorite characteristic of the high Sierra Upon the southern slope of Iron Mountain, there is a variety of igneou rocks, from very acid to basic types, the different types occurring i belts having a general N. 30° E. strike. The contact between the iro deposit and country rock is usually covered but where observed the lin of demarkation between them is sharp and distinct.

However, some large pieces of slide rock show banding of iron wit both acid and intermediate rocks indicating a probable interminglin of materials about the edge of the iron mass. On the northwest sid of the deposit the contact rock is of light gray color of an acid typ

while rocks of an intermediate character are in contact with the iron
at other points.

There are no indications of movement at any of the observed con-
acts. Fracturing in a northeasterly direction, parallel to the strike
of the deposit, is strongly developed through the iron mass. Figure
B shows the portal of a tunnel that is entirely within the iron mass

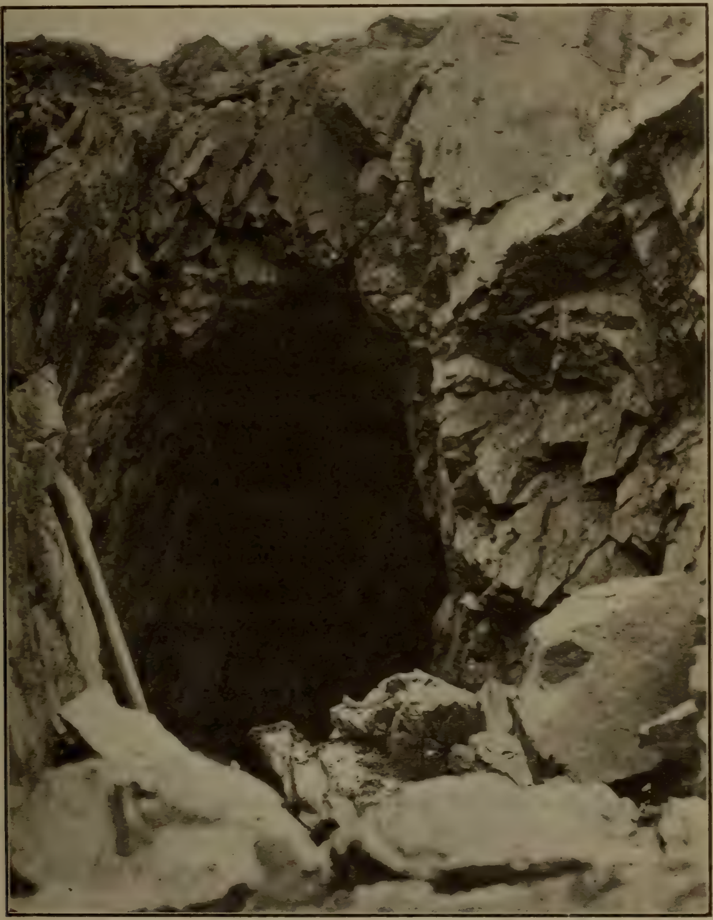


Fig. B. Portal of tunnel in massive iron ore on Iron Mountain.
Photo by F. B. Weeks.

nd the fracturing characteristic of the deposit is here strongly
eveloped. The fracturing is subsequent to the formation of the ore
nd may be wholly due to shrinkage of the mass prior to its complete
nsolidation. In certain narrow belts of the associated igneous rocks
histose structures are developed. No flow structures were observed.
ne slopes of Iron Mountain are covered with slide material composed
the igneous rocks and iron from the deposit.

The deposit is a mass of iron composed of magnetite in which no other material was observed. Its strike is NE.–SW., and its elevation about 11,000 feet above sea level. On account of the slide rock no accurate determination of the surface extent of the deposit could be made. It was estimated to be 2000 feet or more in length, 400 feet in average width, and by erosion on the northeast end it was shown to be 250 feet in depth. On the basis of these estimates there should be thirty million tons of iron ore available. Development may show a greater amount.

The general aspect of the iron mass and the enclosing rocks point to its origin in the differentiation and segregation of materials within the original igneous magma and their consolidation in the form now exposed by erosion. An analysis of a sample taken from the face of a tunnel gave: Fe, 64.14%; Al_2O_3, 1.52%; CaO MgO, 0.53%; SiO_2, 8.60%; P, 0.72% Cu, none; S, 0.60%.

The deposit is within the Sierra National Forest Reserve. It was reported that the deposit is claimed by parties who have made mineral locations. There being no persons in the region at time of examination the names of the present locators could not be ascertained. Approximately 100 feet of underground development work was found within or in close proximity to the iron deposit.

LEAD AND SILVER.

Star Mine. Situated near the summit of Mt. Raymond, NE. ¼, Sec. 10, T. 5 S., R. 22 E., at an elevation of 9000 feet. About 1888 this property was slightly developed, and a concentration plant was erected about 1½ miles distant, near the center of Sec. 16, T. 5 S., R. 22 E. An aerial tramway connected the mine and mill. The intention was to work the ore for its silver and lead content, but the project was a failure after about one year of operation. Very little information is to be had. The plant is at present in a very bad state of repair. About seven years ago an attempt was made to again work the property. It is stated that such ore as was milled contained about 10 per cent of concentrates, valued at $40 per ton and occasionally as high as $100. H. A. Krohn, of Coarse Gold, is the present owner.

Bibl.: R. VIII, pp. 215, 216.

Silver-Lead ores are found in the North Fork Mining district in T. 3 and 4 S., R. 25 and 26 E., but little work has been done of recent years.

Bibl.: R. XI, pp. 218-223.

MINERAL WATER.

There are several soda and sulphur water springs, both cold and hot, near Isberg Pass and the Devil's Post Pile in the extreme eastern end of the county. They are not utilized, however, except by occasional camping parties. Of the hot springs, the most important are the "Red Meadows Hot Sulphur Springs" at the Devil's Post Pile; temperatures 90° to 120° F.

Bibl.: U. S. G. S. Water Supply Paper No. 338, pp. 55, 238, 239, 240, 241, 381.

MOLYBDENITE.

A small deposit of molybdenite was found near the sawmill of the Madera Sugar Pine Company, at Sugar Pine, and some development work done. The deposit proved to be too small. It was said to carry small values in gold.

NICKEL AND COBALT.

H. A. Krohn of Coarse Gold has 80 acres under an agricultural patent in Secs. 23 and 26, T. 10 S., R. 19 E., 12 miles northeast of Madera. While developing for supposed copper values, a body of pyrrhotite ore was opened up, said to assay 7 per cent nickel and 14 per cent cobalt. Development consists of a 100-foot shaft and a short crosscut. No commercial production has as yet been made.

SILVER (see Lead and Silver).

SOAPSTONE.

Brown Deposit. On the north side of the San Joaquin River, a short distance above Friant. Owner, George Brown, Friant. D. Evanger and G. D. Hutchinson, lessees, 3480 Tulare avenue, Fresno. This deposit of talcose schist has been known for twenty-five years, but not utilized except locally. There is a belt of the material about 400 feet wide, striking northwest. Only a small quarry face has been opened up. It is not high grade, but can be sawed into blocks several feet across.

STONE INDUSTRY.

The well known "Raymond" granite quarries near Raymond, in Madera County, not only are and have been for a number of years the most important mineral industry of the county, but they are also an mportant factor in the state's production. As has already been noted see Introduction), these deposits of workable building stone are located n the western edge of the Sierra foothills. There are two quarries bout 1 mile apart, on the east side of a small valley, about 2 miles east f Raymond, which is the terminus of the Berenda-Raymond branch of he Southern Pacific Railroad. Both quarries are served by spur tracks

Photo No. 123. Hearst Memorial Mining Building, University of California, Berkeley. Raymond granite (1903).

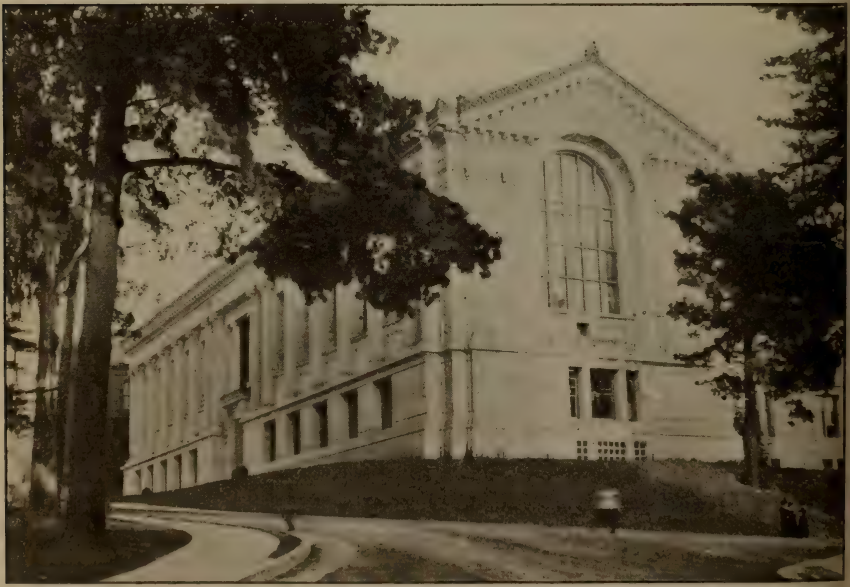


Photo No. 126. University Library, University of California, Berkeley. Raymond granite (1912).

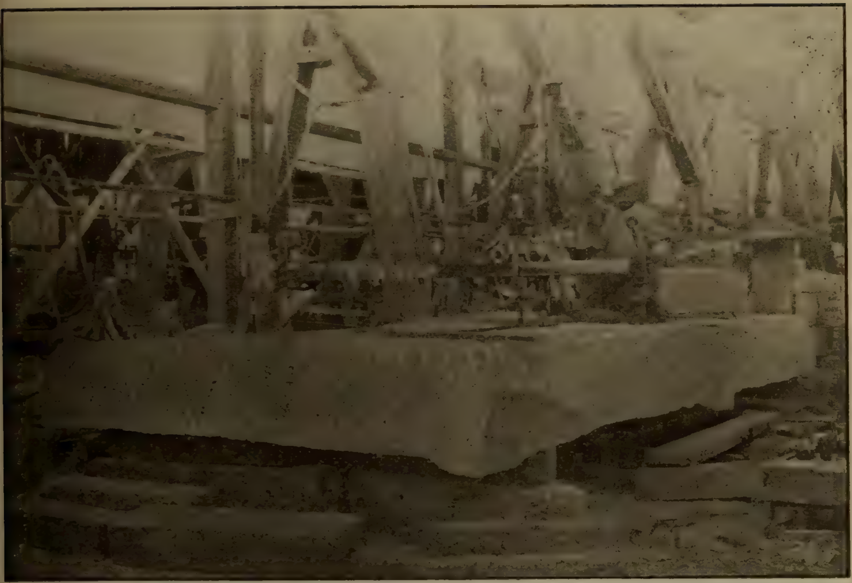


Photo No. 6. Dressing a platform stone (size 21 feet by 6 feet by 2 feet) for the San Francisco City Hall. McGilvray Raymond Granite Company, Madera County, Cal.

Photo No. 8. Sculptural Carving (plaster model at right), for San Francisco City Hall. McGilvray Raymond Granite Company, Madera County, Cal.

from this branch line. It is now recognized that this stone is not excelled by any other building granite found either in this state or elsewhere. It is noted for its beautiful white color, the fineness and uniformity of its texture, its weathering qualities, and its freeness in working. As to this last named feature, it lends itself readily to all classes of fine structural carving.

Madera County Rock Crusher. The county has a rock crushing plant at the McGilvray quarry to utilize waste rock and spalls for road material. It is under the supervision of H. L. Craw, supervisor. Idle in 1914.

Photo No. 129. Sculptural detail on City Hall, San Francisco. Stone from McGilvray Raymond Granite Company, Madera County, California.

McGilvray Raymond Granite Company (formerly McClellan Quarry). John D. McGilvray, president; office, 634 Townsend street, San Francisco; Alexander McGilvray, superintendent at the quarry. Situated in Sec. 27, T. 8 S., R. 19 E. The rock is similar to that described in the Knowles quarry, except in the manner of natural fracturing. Here, no large exfoliation planes have as yet been exposed; but cross fractures some 20 to 30 feet apart occur, besides occasional small dikes. The quarry is a side hill cut worked on about the same scale as the other, but covering a smaller area and deeper. Equipment includes 6 derricks with oil-burning steam hoists, 2 saw sets, 4 overhead traveling cranes on two runways, and a locomotive track crane. The two compressors are driven by 150 h.p. and 250 h.p. motors, electric power being obtained from the line of the San Joaquin Light and Power Company, installed this year (February, 1914). Most of the work is done with pneumatic tools.

This summer the quarry has been employing from 250 to 300 men, the largest force in its history. This is mainly due to their furnishing the stone for the new San Francisco City Hall, the granite contract alone for which represents a value of $991,313. The architectural plans call for a large amount of fine sculptural detail, and this work is practically all done at the quarry sheds. In this department there were seventeen carvers working under a special foreman. The majority of these artists (for "artists" they must be to do such work) are Italians and Scotchmen. Among the larger blocks finished are several platform pieces for the City Hall, 21′ x 6′ x 2′. (See photo No. 6.)

The product has an extensive market, another example being the United States Custom House in San Francisco. The four monolithic Doric columns at the First National Bank are also from this quarry. The largest single piece shipped from this quarry was 14′ x 13′ 10″ x 2′ for the top of a mausoleum in Cypress Lawn Cemetery, San Mateo County.

Bibl.: R. XII, p. 384; XIII, p. 620; Bull. 38, p. 32.

Raymond Granite Company (also known as the Knowles Quarry). F. E. Knowles, president; office, Division street and Potrero avenue, San Francisco; F. J. Krebs, superintendent at the quarry. Situated in Sec. 22, T. 8 S., R. 19 E. Operations have continued since 1888 with varying activity, there being at present (July, 1914) 175 men employed about the entire plant. The company owns some 1700 acres. About 5 or 10 acres are free of weathered overburden on a low rounded hill (see panoramic photo No. 4A). The rock breaks to extensive fractures lying nearly parallel to the ground surface and from a few inches to 15 or 20 feet apart. Cutting of these immense slabs is done principally by wedges with a little powder used occasionally. A channeling machine is also employed. (See photos Nos. 1, 2 and "M".)

The largest single piece reported was 4′ x 4′ x 40′, but much larger blocks could doubtless be obtained. The stone is completely dressed or carved at the sheds adjoining the quarry, where air-driven machines are used. The equipment includes 6 derricks with oil-burning steam hoists, 2 sets of saws, and overhead traveling electric cranes (3 large and 2 small). Until February of this year oil has been used to generate power, since which time the San Joaquin Light and Power Company has been furnishing electricity. The steam plant is still maintained as an auxiliary. The stonecutters receive $5 per day for eight hours.

Photo No. 4A. Raymond Granite Company's quarry near Raymond, Madera County, California. Panoramic view of quarry from below.

Photo No. 1. Raymond Granite Company, Madera County, Cal. Upper part of quarry.

Photo No. 2. Wedging out a large block of granite (about 10 feet by 20 feet by 5 feet). Raymond Granite Company, Madera County, California.

Monumental and building stone has been furnished to many large structures, among which may be mentioned the San Francisco post office, Municipal Auditorium, the U. S. Sub-Treasury Building and the Fairmont Hotel; also for buildings at the University of California in Berkeley. Of the latter, the most striking example is the Campanile, or bell tower, a shaft of 34 feet square base and 305 feet in height to the top of the surmounting bronze lantern. On the front of the new U. S. Sub-Treasury Building in San Francisco are ten Doric columns about 4½ feet in diameter and 27 feet long, each in three sections. As originally drawn, the specifications called for these columns to be monolithic. The change was made because of the greater cost of handling. As has already been pointed out even larger monolithic pieces than that can be obtained here. We were informed that the cost of cutting would be practically the same, but that the necessity of providing heavier equipment to handle them would have increased the cost $2000 for the ten columns in question, or $200 per column. It seems to the writer that it would have been money well spent, for the beauty of the building would have been enhanced many times.

Photo "M". Raymond Granite Company's quarry, Raymond, Madera County, California.

Bibl.: R. X, p. 189; XII, p. 384; XIII, p. 620; Bull 38, pp. 30–32.

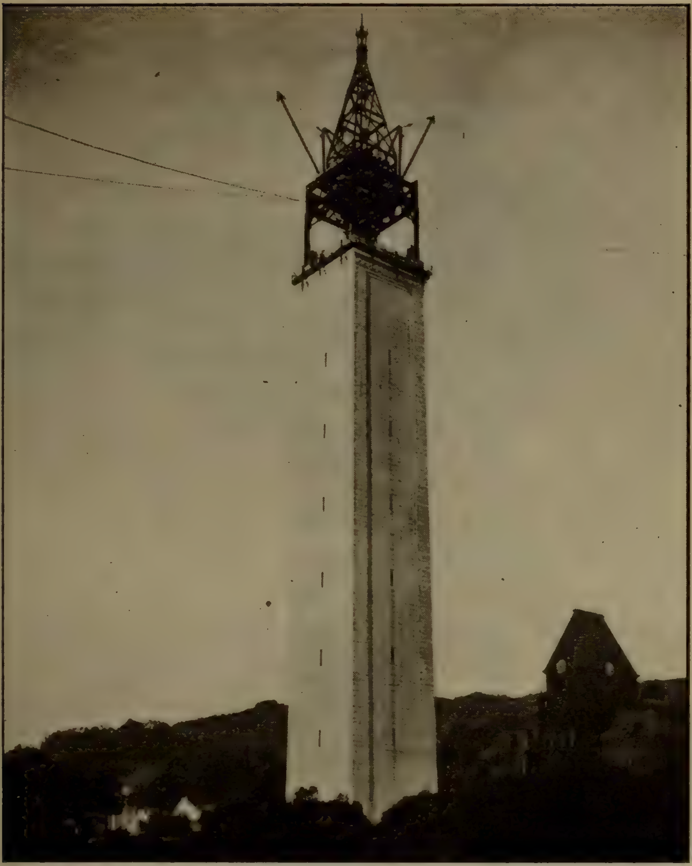


Photo No. 125. Sather Campanile, University of California, Berkeley. Stone from Raymond Granite Company, Madera County, California.

Sand and Gravel.

Primmer Artificial Stone Plant. B. J. Primmer of Madera has a plant which is producing concrete pipe and culverts. California cement is used with sand and gravel obtained from the Fresno River north of Madera.

Santa Fe Gravel Company (formerly San Joaquin River Rock and Gravel Company). F. Knobloch and Louis Manuel, owners, 1929 Fresno street, Fresno. This gravel pit on the San Joaquin River, in Sec. 32, T. 12 S., R. 19 E., is 1 mile north of Herndon station on the Southern Pacific railroad, but ships via Knobloch spur on the Santa Fe. It was opened up about 1904. The material is moved by Fresno scrapers to a trap over dump cars; then hauled $\frac{3}{4}$ mile by mules on a light track to the railroad spur. Formerly a dinky locomotive was used. The plant has a capacity of 100 tons per day, with six men employed. The product is not screened at the pit.

TALC (see Soapstone).

TUNGSTEN.

Wolframite occurs in the form of masses and large crystals in a quartz vein in andalusite schist, 12 miles north of Raymond. The deposit is undeveloped.

Bibl.: Bull. 67, p. 176.

VOLCANIC ASH.

Mineralite Manufacturing Company. G. D. Hutchinson, president, M. H. Heitzig, secretary; office and factory, 3480 Tulare avenue, Fresno. This material is an extremely fine, powdery, though somewhat compacted volcanic ash, the deposit being on the ranch of C. D. Armstrong, in Sec. 1, T. 11 S., R. 20 E., 2 miles northwest of Friant. It was first worked about 15 years ago in a small way and used for a polish. The present lessees incorporated in March, 1914, and have developed the deposit to a depth of 20 feet to 30 feet by open cut. They ship the material to their plant in Fresno where it is crushed, and bolted through a 125-mesh screen. The product is marketed in the form of a polishing powder, and as scouring and polishing soaps. At the pit two men are employed intermittently.

ZINC.

It is stated that zinc is found in some of the ores of the Minarets district. It is also found in the North Fork Mining District.

Bibl.: R. XI, p. 222.

MARIPOSA COUNTY.

By F. L. LOWELL, Field Assistant.

Field Work in July, 1914.

Mariposa County might be said to possess more distinctions than any other county in California from the fact that not only does the southern extremity of the famous "Mother Lode" of the State end in this county but also that the famous Yosemite Valley and Mariposa Grove of Big Trees are included in it.

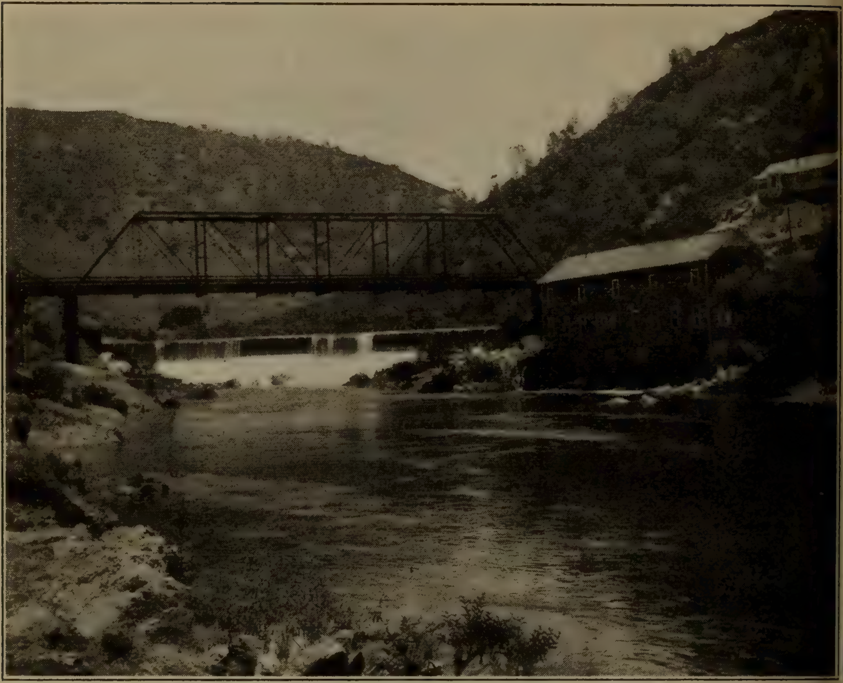
The county is bounded on the north by Tuolumne County, on the outheast by Madera County, and on the west and southwest by Merced County. The greater portion of the county is drained by the Merced River and its branches with the exception of that portion extending rom the Mariposa Grant to the south end of the county. While the ounty receives a fair amount of rainfall, yet water is not very abundant during the summer and the power used in the prosperous days of mining in the county was derived from the then abundant wood fuel. Wood as a fuel at the present time is too expensive for working the rade of ores that now prevail.

POWER.

Some mines along the Merced River develop hydroelectric power from he river for their own use and the Mariposa Grant also supplies a mited amount of power for lighting purposes and mill power from its lant on the Merced River at Bagby. Their lines run from the Merced iver through the grant to the towns of Mt. Bullion and the county at, Mariposa. The plant consists of a flume 400 feet long by 16 et wide and 6 feet deep which carries water under a 34-foot head three Pelton wheels which are 27, 30 and 40 inches in diameter, spectively. The plant is capable of developing 600 horsepower and e power is generated by two Westinghouse dynamos.

The Pacific Gas and Electric power line comes from Tuolumne County the Peñon Blanco mine and thence through the town of Coulterville the Potosi gold mine owned by the Merced Gold Mining Company.

A company formerly had a power plant at Exchequer on the Merced ver, but their plant was washed out during the heavy freshet of the nter of 1913. The San Joaquin Power and Light Company, which nerates power from Merced Falls in Merced County, owns a power e which extends as far as the Mt. Gaines mine in the Hornitos ning district. This company also uses the Exchequer line for transtting power.



Mariposa Commercial and Mining Company's dam and hydroelectric plant on the Merced River at Bagby, Mariposa County, California.

GEOLOGY.

Mariposa County is about 65 miles long and 35 miles wide. The serpentine, amphibolite schists and metamorphic slate belt comes as far south as the Mariposa Grant and south of this estate the granites of the eastern portion of the county crowd over toward the west, thus ending the so-called "Mother Lode." The "Grant" boundaries appea to be well chosen so far as including most of the Mother Lode vei south of the Merced River is concerned, for, outside of these boundaries the veins are smaller.

In the southeastern section of the county there is a limestone bel with a northeast and southwest direction which extends for some distance through the county. This limestone belt carries copper in considerable quantities. The formation in the eastern part of the count which is taken up by the Yosemite National Park, is mostly of granit and heavily timbered. No mineral is reported and no prospecting i being done within the boundaries of the National Park.

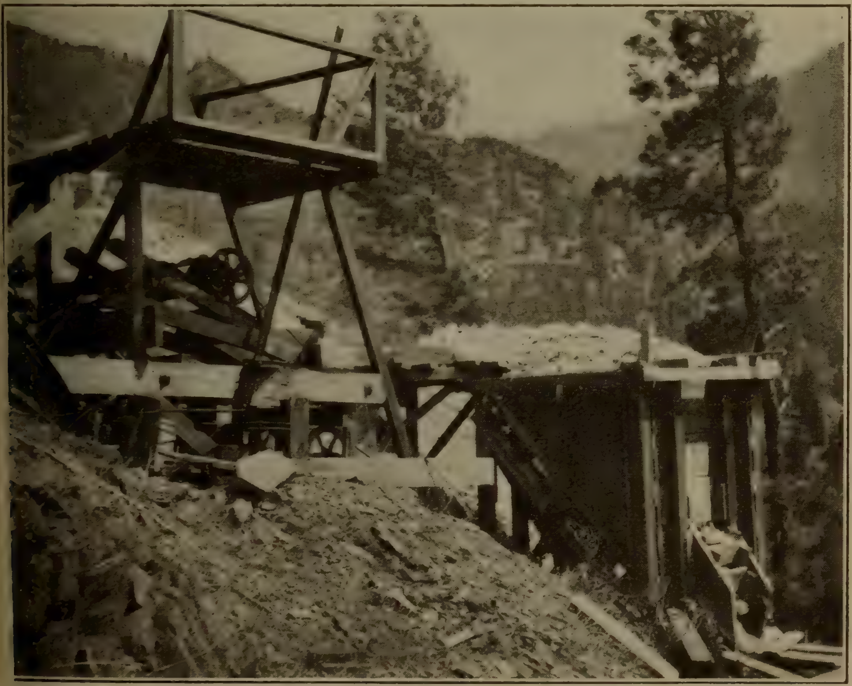
Mariposa County had many producing mines at one time but many o the larger ones reached a zone of decreased values and ceased operation at this point. On the Mother Lode in other counties, this same lean zon has been encountered and, in some cases, it has been pierced and bette values found below. This advanced prospecting has not been done i any extent in this county, and it remains to be proven whether the shoots go down. Some of the mines have very enviable reputations as producers from the surface down to the point of abandonment. The fuel question has been a drawback to the county of late years. There are ores that could be worked at a profit if cheap power could be had. Wood costs $2.50 to $4 per cord delivered.

ASBESTOS.

Some asbestos of the amphibole variety has been found east of the Mariposa Grant, the exact locality not being known. It is impure and not being worked.

BARYTES.

El Portal Mining Company, whose office is at 354 Pine street, San Francisco, owns considerable barytes (heavy spar) on the north bank of the Merced River, about one mile down river from El Portal. The plant consists of a bin at the railroad tracks, also a bin at the quarry, a surface tram down the hill and two ore cars. No one was working in the quarry at the time the plant was visited. A very good quality of barium sulphate is produced.*



l Portal Mining Company's barytes quarry on the Merced River one mile below El Portal, Mariposa County, California.

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*The property is under lease to the Barbour Chemical Company, which has a plant Melrose, Alameda County, Cal., manufacturing barium compounds.

COPPER.

Copper mining in the county has not reached large proportions and the southern end of the county is the only place where any work is being done and not much even there. Leasers are taking out most of the copper that is being shipped. This ore is freighted by wagon to the railroad at Raymond in Madera County and shipped to the smelters. This county is said to have had the first smelter in the State, the ruins of which are still standing not far from Green Mountain. The copper belt in this county extends for forty miles and considerable copper ore was mined in the early days, but the industry has dwindled to very insignificant proportions. Those properties that are operating at present will be described and a few of the new groups mentioned, but for the older and idle properties reference can be found in Bulletin No. 50, "Copper Resources of California," issued by this Bureau in 1908.

Remains of what is said to have been the first smelter in California, near Green Mountain in southern Mariposa County, California.

Green Mountain Copper Group. This group, which consists of eight mineral claims and 26 acres of patented agricultural land, is situated in Sec. 3, T. 8 S., R. 18 E., M. D. M., about 8 miles by wagon road northwest of the railroad at Raymond in Madera County and owned by the Legioneer Gold Mining Company and J. B. Pearce. Two of the eight claims are patented, namely, the Copper Queen and Buena Vista The Copper Chief, Buster Brown, Cuban Nigger, Flotsom, Jetsam, and Amador claims are not patented. The first claims were located in 186 and have been worked and shut down at various times. The ores consist of copper oxides and carbonates. There are about 4,000 feet of underground works. A gossan capping covers the schist which carries the copper ores in the form of replacements. The mine is worked through tunnels. At present there is very little equipment on the ground with the exception of a horse whim, three ore cars and drill steel, also a dwelling house. Three leasers are working at present. Fifty-two cars shipped averaged $1,000 per car, but did not carry gold values. Assays showed 2 ounces in silver.

Pocahontas Copper Mine. This property, which consists of 320 acres of patented land, is situated in Sec. 14, T. 7 S., R. 17 E., M. D. M., about 16 miles northeast by wagon road from Le Grande in Merced County, which is on the Atchison, Topeka and Santa Fe Railroad. The property is owned by a stock company called the Pocahontas Mining Company, with their home office in San Francisco. The exact date of ocation is not known, but supposed to have been located in the early sixties. The mineral bearing formation is gossan, several seams of which run through the county, and the ores are principally sulphides and carbonates, the carbonates predominating down to about 100 feet when the sulphides take principal place. The greatest depth attained s by shaft, which is down 300 feet; 900 feet of drifting has been done, nd a 200-foot tunnel has been driven on the vein. The mine equipment consists of a donkey engine, skip, tools, blacksmith shop, assay ffice, timber shed, and dwelling house. All the ore was shipped to the elby Smelting and Lead Company by way of Le Grande. Two men are leasing the property now.

San José Copper Group. This group of copper claims, which was ormerly known as the Cavan Copper Mine, consists of nine claims and ne mill site all unpatented, and is situated in Secs. 5 and 8, T. 8 S., . 18 E., M. D. M., about 10 miles northwest by wagon road from Raymond in Madera County. The property is owned by S. L. Pearce. hese claims were located about fifty years ago and they consist of 170 res. The lode is schist carrying replacement copper. The mine is orked by a 150-foot shaft. There are sixty-five feet of drifts, also few prospect shafts and a crosscut tunnel. The only equipment consists of a horse whim, mine bucket and drill steel. The mine is being orked by Mr. Pearce, who has shipped seven carloads of ore to the lby Smelting Works. They are said to have averaged $1000 per car. he ore carries $2.50 per ton in gold. The costs are $3.50 per ton for uling to the town of Raymond and $2.25 per ton railway charges to e smelter. Total costs per ton are $12. A patent has been applied r, but not granted on account of litigation with homesteaders.

A group of 26 copper claims located in Sec. 30, T. 5 S., R. 19 E., just east of the Mariposa Grant near Mormon Bar in March, 1913, has been prospected in some places and bonds have been taken out on them, but so far no one has developed them. The ore carrying formation is quartz porphyry.

Another group of copper claims is located in Secs. 19 and 20, T. 6 S., R. 20 E., M. D. M., and is called the *Indian Peak Group.* There are fifteen claims in the group and most of the development work has been done on the Indian Peak claim. The copper ores which are in limestone with granite walls are mostly carbonates and sulphides. This limestone belt has a northeast and southwest direction and can be traced for some distance through the county. There are two incline shafts each 35 feet deep and both are in ore. There are four tunnels, one 12 feet long, two 20 feet each, and another 50 feet long. The claims hav a cabin and blacksmith shop on them. No work is being done at present The Indian Peak claim was located twenty years ago and the othe claims were located in 1913.

Copper dump on the property of the Indian Peak copper claims, Mariposa County, California.

Another group of copper claims in the Indian Peak district comprise seven claims and are owned by *Mrs. Emma Chard* of Red Bluff. Thes claims are not developed.

A second group of five claims in the same district is owned by J. L. Divens, Mrs. E. McKeith, Lee La Valley, and Matt Logan. There is a 20-foot tunnel on one of the claims and a shaft on another, but very ittle work has been done.

There is also a *copper vein* on the Mariposa Grant, in Sec. 18, T. S., R. 18 E. The strike is northeast. The vein is in slate walls and as not been developed. It is about seven feet in width on the surface.

GOLD (LODE).

Gold mining in the county has suffered a relapse since the boom days otwithstanding the large production of some of the mines. The shutng down of the larger mines on the Mariposa estate and also those f the Merced Gold Mining Company in the Coulterville district, has, n a large measure, put a damper on mining, and the fact that cheaper ower is not always available for working the lower grade ores also ampers the industry. While many of the older mines have reached a ne of unpayable values, yet there are numerous new properties that ow promise of developing into mines if the necessary capital and ergy are forthcoming. Many of these properties will be mentioned in e following list:

Adelaide Quartz Mine. Owned by the estate of Mary P. MacCrellish. . P. Edwards of Alameda, manager. The claim is patented and cated in Secs. 22 and 23, T. 3 S., R. 16 E., M. D. M., 1½ miles by agon road from Kittridge. The vein, which has a northwest strike, is tween serpentine footwall and slate hanging-wall, and ranges from to 10 feet in width. About 2500 feet of development work, one tunnel d an old incline shaft 150 feet deep. The equipment consists of a drill Sullivan air compressor, blacksmith shop, and boarding house. e mine was bonded, but the bond lapsed July 1, 1914, and is now idle.

Aden Quartz Mine. Owned by the Aden Mining Company, box 242, llejo. Very little information could be obtained on this propey. There is a crosscut tunnel 300 feet long, 180 feet of drifts, ad two shafts, one 105 feet and the other 40 feet in depth. Now idle.

Alice Quartz Mine. Owned by the Mariposa Commercial and Mining mpany, Alaska Commercial Building, San Francisco. The propey consists of two claims located in Sec. 16, T. 5 S., R. 17 E., M. D. M., 1 miles by wagon road to Merced Falls in a westerly direction. The n of quartz lies between slate walls and averages 3 feet in thickness. e development consists of a 200-foot shaft, three levels with 360 feet o drifts, a winze 27 feet deep and a raise 38 feet long. There is no ne equipment on the property and it has not been worked since 1902.

nderson Quartz Mine. Owned by the estate of Mary P. MacCrelli, W. P. Edwards of Alameda, manager. The property consists of one patented claim located in Sec. 23, T. 3 S., R. 16 E., M. D. M., about 1½ miles by trail north from Kittridge and 5 miles by wagon road to Coulterville. The quartz ledge has serpentine footwall and slate hanging-wall and measures from 4 to 12 feet in width. The development consists of a 30-foot incline shaft, 3 levels and a tunnel 120 feet on the vein. The equipment consists of shaft with rails, one skip, 25 h.p. motor hoist, one bailing skip and pump. There is also a blacksmith shop, engine house, bunkhouse, and boarding house. The mine has been under bond, but it expired July 1, 1914, and is now idle.

Artru Mine (pocket). Owned by H. Artru and consists of a fraction of a claim 450 feet in length and located in Sec. 27, T. 4 S., R. 18 E., M. D. M., 3½ miles by trail from Saxon Creek station on the Yosemite Valley Railroad and 20 miles by wagon road to Bagby. The ore body is a porphyry dike said to average 20 feet in width and having slate hanging-wall and footwall. The development consists of a 75-foot shaft, 450 feet of drifts, 4 crosscut tunnels each about 140 feet long and several small raises. There is a cabin on the claim and a wheelbarrow and drill steel. The gold obtained is of the crystallized variety The mine has been shut down for two years.

Austin Quartz Mine. Owned by the Austin Group Mining and Milling Company, 244 Kearny street, San Francisco. Consists of fou unpatented claims, located in Secs. 29 and 32, T. 4 S., R. 18 E., M. D. M. 25½ miles by wagon road to Bagby on the Yosemite Valley Railroad The quartz vein is from 6 inches to 4 feet in width and lies between porphyry walls. The development consists of two incline shafts each 120 feet deep, one crosscut 700 feet long and a drift 150 feet long, also one stope 60 feet long by 120 feet high. The equipment consists of hoist, blacksmith shop, 10-stamp mill, compressor, one Pindar concentrator, and Challenge feeders. The mine has not been working for th past one and one half years.

Bank of California Quartz Claim. Owned by G. E. Dunbar of 51 Southwest street, Kalamazoo, Mich. There are two unpatente claims, located in Sec. 27, T. 4 S., R. 18 E., M. D. M. The vein o quartz averaged 2½ feet in width and has porphyry and slate wall The development consists of a 50-foot shaft, also a 75-foot shaft, which is now filled up. Is idle at present.

Black Log Quartz Claim. Owned by F. N. Clark and Wm. Bus of Mariposa. This is a prospect located in Sec. 13, T. 4 S., R. 18 E M. D. M., and the only development work done consists of an inclin shaft 70 feet deep. The vein is 8 inches to one foot in width. On assessment work is done.

Blue Bell Quartz Mine. Owned by Hiram W. Branson and located n Sec. 9, T. 4 S., R. 20 E., M. D. M., 10 miles by trail from El Portal, ear Jerseydale. The property consists of two unpatented claims and he vein of quartz lies between porphyry footwall and slate hanging-vall and has an average width of 5 feet. The development consists of 145-foot crosscut tunnel and 80 feet of drifts. No equipment outside f an iron ore car, drill steel, and blacksmith shop. Mine not working.

Bogan & Baitaille Quartz Mine. Owned by Fred Mebold and conists of one patented claim located in Sec. 26, T. 4 S., R. 18 E., M. D. ., 20 miles by wagon road from Bagby. The quartz vein which verages about 2½ feet wide has a prophyry footwall and a slate hangng-wall. The development consists of four adit levels being 60, 100, 50, and 300 feet long, respectively, and several raises. The equipent consists of one ore car, mortar and spring pole, and a blacksmith hop. The mine is not working at present.

Bondurant Quartz Mine. Owned by A. L. Adams of 307 Center treet, Bridgeport, Conn., and consists of 100 acres of patented claims, lso 700 acres of patented timber land located in Secs. 25 and 36 in . 2 S., R. 16 E., M. D. M., 13 miles north of Bagby by wagon road. he ledges are quartz and there are eight of them. They have slate alls and the Bondurant vein is 7 feet wide, the Reynolds 4 to 10 feet, nd the Louisiana 4 to 15 feet. The development consists of a 412-foot cline shaft, 975 feet of drifts, 945-foot crosscut on river level, and 25-foot crosscut on adit level; also 150-foot air raise and 20-foot winze. he Reynolds shaft is down 125 feet. There are 5 stopes. The equipent includes a hoist, one Ingersoll-Sargent compressor, 40 h.p. boiler, machine drills, skip, 2 blacksmith shops, drill steel, compressed ir pipe, and one Worthington pump. The reduction equipment cludes a 10-stamp mill (1000-pound stamps), rock crusher, Challenge eders, two 4′ x 16′ plates, two Union tables, one Dean pump, mill gine, two small pumps and one 60 h.p. boiler. Five men were working ing development work. G. H. Gerkin, superintendent.

Booth Quartz Claim. One claim patented, owned by C. L. Booth of ariposa, and located in Sec. 5, T. 5 S., R. 20 E., M. D. M. The rike is northwest and southeast and dips northeast about 45°. There e two shafts, 28 and 95 feet deep, and one tunnel 120 feet long. The in varies from a few inches to 18 inches in width. No work is being ne.

Bowman Quartz Claim. A pocket claim owned by F. N. Clark of ariposa, located in Sec. 26, T. 4 S., R. 18 E., M. D. M. There are veral prospect holes and shafts. Nothing being done at present.

Bull Dog Quartz Claim. Consists of one claim owned by Theodore Kokel of Lyons Gulch and situated in Sec. 31, T. 4 S., R. 18 E., M. D. M., 25 miles from Bagby on Yosemite Valley Railroad. The vein of quartz varies from 2 to 4 feet in width and lies between porphyry walls. Only assessment work is done each year and there is only a windlass on the property.

Bull Pup Quartz Claim. Consists of one claim owned by Jack Zerney of Merced, located in Sec. 31, T. 4 S., R. 18 E., M. D. M., 25 miles from Bagby by wagon road. The vein is 2 to 4 feet wide in porphyry walls and the development consists of an incline shaft 165 feet deep and 100 feet of drifts. There is practically no equipment with the exception of a windlass and a wooden skip. The claim has been relocated from year to year.

Bunker Hill Quartz Claim. Owned by Charlie Lewis of Hites Cove. The claim is located near Hites Cove and is said to have had the first quartz mill in the state in 1851. The claim is still unpatented and has had considerable development work done on it. The mine was discovered from quartz brought to the surface in a squirrel hole and was formerly called the Squirrel Mine. Still held by possessory rights.

Busch Quartz Mine. Three unpatented claims owned by L. F. W. Busch of Mariposa, located in Sec. 21, T. 4 S., R. 18 E., M. D. M., 4½ miles south of Briceburg and 22 miles from Bagby by wagon road. The vein is 16 feet wide at the surface and 9 feet wide in the bottom of the shaft, and the walls are slate. The development consists of a 180-foot shaft, 140 feet of drifting, one winze, length unknown, and one crosscut 67 feet long. There is a blacksmith shop and hoisting shed, also windlass, in the way of equipment. Only assessment work is being done.

Busch Quartz Claim. One unpatented claim owned by L. F. W. Busch, situated in Sec. 28, T. 4 S., R. 18 E., M. D. M., east of the Diltz mine. The vein which is in porphyry walls is 2 feet wide and has a strike of northwest and southeast and dips northeast. Only assessment work is being done.

Champion Quartz Mine. Consists of one unpatented claim owned by G. E. Dunbar of Mariposa, and located in Sec. 27, T. 4 S., R. 18 E. M. D. M., 22½ miles by wagon road from Bagby. The quartz vein averages 4 feet wide and has porphyry footwall and slate hanging-wall Development consists of a shaft 9 feet deep, 188 feet of drifts, 3 levels and an air shaft 60 feet to surface. No equipment remains on the property. Only assessment work is done.

Cohen Quartz Mine. Consists of one patented claim owned by a man by the name of Cohen and is situated in Sec. 33, T. 4 S., R. 18 E. The claim was patented in 1912, but has not been worked for some time. Very little information could be obtained about the mine.

Colorado Quartz Mine. Consists of three claims, one of which is patented, owned by P. W. Judkins, C. H. Weston and I. L. Dearborn of Mariposa and located in Sec. 27, T. 4 S., R. 18 E., M. D. M., 22 miles by wagon road from Bagby. The vein is a true fissure vein with slate walls and averages 2 feet in width. The development consists of an adit level 500 feet long, an air raise 119 feet long and a second raise 75 feet long, also a winze 14 feet deep. There is one stope 120 feet long and 35 feet high. The equipment consists of a gasoline hoisting engine, 4 ore cars, drill steel, 10-stamp mill, rock crusher, Challenge feeders, two 5′ x 10′ amalgamating plates, 2 tables, 2 vanners, and a blacksmith shop. There is also an assay office, change house, bunkhouse, office, storeroom, and dwelling house. There is a surface tramway from the mill to the wagon road above. This mine was being developed at the time it was visited.

Colorado Gold Quartz Mine on Long Gulch Creek, Whitlock mining district, Mariposa County, California.

Colorado Quartz Claim. Consists of two claims, one of which is patented, owned by P. W. Judkins, C. H. Weston and I. L. Dearborn of Mariposa and located in Sec. 32, T. 4 S., R. 18 E., M. D. M., 30 miles by wagon road from Bagby. Fissure vein in slate is 2 to 6 feet wide. The development consists of a 500-foot adit level, 140-foot raise to surface, another 65-foot raise and 13-foot winze. One stope 300 feet long. Equipment consists of 3 ore cars, tools and blacksmith shop. There are also a Gates rock crusher, 2 Gates tables, 2 vanners, assay office, bunkhouse, and superintendent's house. There are 5 gas engines all told for the plant. The mine is working most of the time.

Comet Gold Mine. Consists of three unpatented claims owned by the Comet Mining and Milling Company of Kansas City, Mo., and located in Sec. 22, T. 4 S., R. 19 E., M. D. M., 15 miles by wagon road from the town of Mariposa. The quartz vein averages 2½ feet wide and has a granite footwall and slate hanging-wall. The development consists of two adit levels in which 785 feet of drifts have been run, also 100 feet of crosscut, two raises, one 40 feet and one 168 feet and one winze 45 feet deep. The equipment consists of 3 iron ore cars, drill steel, ventilating pipe, 10-stamp mill, Blake rock crusher, Challenge feeders, 2 amalgamating plates, 4′ x 12′ Deister tables and clean-up frame. There is also a sawmill and 45 h.p. boiler for the same, and overshot water wheel for the ventilating fan. The steam is piped 300 feet in naked pipe to the stamp mill. The buildings include bunkhouse, office, residence, storehouse, assay office and cookhouse. The mine was not working at the time it was visited, but was being examined.

Compromise and Eubank Quartz Mine. Consists of 40 acres owned by J. A. Flink and R. C. Haywood and located in Secs. 30 and 31, T. 2 S., R. 18 E., M. D. M., 30 miles from the railway. The vein averages 2 feet in width between hard slate walls. The development consists of a shaft 350 feet deep, 100-foot winze, and three levels each 100 to 700 feet long. The property has been idle for thirty years and has recently been bought by the present owners from P. J. and W. W. Hilliard.

Cranberry Quartz Mine. Consists of one patented claim and a mill site owned by A. H. Ward of 53 Stevenson street, San Francisco, located in Sec. 15, T. 3 S., R. 19 E., M. D. M., on the Yosemite Valley Railroad. The vein is 3 to 6 feet wide, and is a fissure vein in slate walls. The development consists of 410 feet of shaft and winze, 1240 feet of drifts, winze 300 feet deep and a raise 460 feet long. There is no equipment on the property at present. It has not been worked for twenty years.

Crown Lead Gold Mine. Consists of one patented claim owned by the estate of Mary P. MacCrellish; W. P. Edwards, manager, of Alameda, and located in Secs. 26 and 36, T. 3 S., R. 16 E., M. D. M., on the Yosemite Valley Railroad. The vein is 10 feet and has a serpentine footwall and slate hanging-wall. The development consists of a 50-foot incline shaft and a 25-foot tunnel. There is no equipment on the property and the underground works have caved. The property was under bond, but it expired July 1, 1914.

Crown Peak Quartz Mine. Consists of one patented claim owned by the estate of Mary P. MacCrellish and located in Sec. 36, T. 3 S., R. 16 E., M. D. M., at Kittridge on the Yosemite Valley Railroad. There are two veins averaging 7 feet in width and having serpentine footwall and slate hanging-wall. The development consists of a 45-foot incline shaft and a 50-foot open cut. There is no equipment on the property. It was under bond but it expired July 1, 1914. The mine has not been worked for many years.

Diltz Quartz Mine. Consists of two claims, one of which is patented, owned by S. J. Harris and wife of Jerseydale, and located in Sec. 29, T. 4 S., R. 18 E., M. D. M., 3 miles by road and 5 miles by trail to Briceburg. The vein is 20 inches wide and has diorite footwall and slate hanging-wall. The development consists of a 30-foot drift and one adit level, also a 60-foot crosscut and winze 22 feet deep. The equipment consists of one small skip, one hand pump, 22 feet of 1½-inch water pipe, and a blacksmith shop. Some work has been done the past summer by the Mariposa Mines Development Company.

Early Quartz Mine. Consists of one unpatented claim owned by the August Revel estate and Eli Revel, and located in Sec. 27, T. 4 S., R. 19 E., M. D. M., 6 miles south of North Fork on the Yosemite Valley Railroad. The vein is from 3 to 6 feet wide in granite walls. The development consists of one adit level 800 feet long, one 40-foot crosscut tunnel and one stope 800 feet in length by 150 feet high. Equipment consists of a 10-stamp mill run by a 25 h.p. steam engine, one boiler, one amalgamating plate, 4 feet by 8 feet. The workings have caved and the mine is not working.

Elizabeth Quartz Mine. Consists of patented claims owned by the Mariposa Commercial and Mining Company, Alaska Commercial Building, San Francisco, and located in Sec. 5, T. 5 S., R. 17 E., M. D. M., on the Mariposa Grant, 16 miles by wagon road from Merced Falls. The vein averages 6 feet in width and has a slate footwall and diabase hanging-wall. The development consists of a 100-foot incline shaft and 100 feet of drifts, also one stope. The equipment consists of hoisting engine, one 40 h.p. boiler, ore car and blacksmith shop. This property has been worked by leasers only but has been closed since 1911.

Emma Quartz Mine. Consists of one unpatented claim owned by Marcus Shinskie, and located in Sec. 36, T. 3 S., R. 19 E., M. D. M., about five miles from the wagon road to Hites Cove. The vein swells and pinches and has a diorite footwall and slate hanging-wall. The development consists of a 90-foot tunnel and two other tunnels that have caved, also two 50-foot raises and a winze 4 feet deep. There are three stopes. There is practically no equipment on the property and it is now idle.

Farmers' Hope Quartz Mine. Consists of seven quartz claims (one patented), two placer claims, and a mill site owned by G. L. Kennedy of Mariposa, and situated in Sec. 29, T. 4 S., R. 18 E., M. D. M., 25 miles by wagon road from Bagby. There are three veins, one contact with mariposite footwall and porphyry hanging-wall. The development consists of two shafts and 1125 feet of drifting, one crosscut 385 feet long, 440 feet of raises and a 35-foot winze. The equipment consists of a gasoline hoist, one skip, 5-stamp mill, rock crusher, mill feed, one Frue vanner, one amalgamating plate 4′ x 10′, one 10 h.p. engine and one 12 h.p. boiler. The mine is not working at present and is for sale.

Feliciana Quartz Mine. Consists of one patented claim owned by J. B. Campbell of Mariposa and located in Secs. 12 and 13, T. 4 S., R. 18 E., M. D. M., 5 miles southeast of Briceburg by trail. The vein is from 2 feet to 6 feet in width and has slate walls. The development consists of a 700-foot tunnel, 600 feet of drifts, 400-foot crosscut, two winzes—one 40 feet and the other 55 feet deep. There is also a stope 700 feet long and 650 feet to the surface. The equipment is about all gone, only some grinding pans being left. The mine has not been worked for thirty years.

Geary Quartz mine. Consists of one claim, unpatented, owned by Mrs. Potter and located in Sec. 30, T. 4 S., R. 18 E., M. D. M., 25½ miles by wagon road from Bagby. The vein averages 3 feet wide and has a slate footwall and porphyry hanging-wall. The development consists of an incline shaft 100 feet deep and 325 feet of drifting. There is no equipment on the property and the mine is idle.

Gray Eagle Quartz Mine. Consists of two unpatented claims owned by B. C. Gruby of Coulterville and located in Sec. 30, T. 3 S., R. 17 E., M. D. M., 3 miles from Bagby by wagon road. The dike of porphyry consists of a 133-foot shaft, 355 feet of drifts, 300-foot crosscut tunnel and two stopes—one 60 feet by 40 feet and the other 60 feet by 35 feet high. The shaft has a double compartment and there is only one ore car and windlass on the ground. Mine is under bond and work is supposed to begin on August 1, 1914.

Golden Gate Group. Consists of three unpatented claims and a five-acre mill site owned by Chas. A. Schlaguerty of Mariposa and located in Secs. 18 and 19, T. 4 S., R. 17 E., M. D. M., 7 miles by wagon road from Bagby. The vein is from 3 to 6 feet in width and has a mariposite footwall and a slate hanging-wall. The development consists of a 210-foot shaft, an adit level 250 feet long, 250-foot crosscut and a 20-foot raise. There is only some drill steel and a small skip together with a blacksmith shop and a shed over the collar of the shaft. The mine is not working at present.

Greens Gulch Quartz Mine. Consists of one patented claim, owned by the Mariposa Commercial and Mining Company and located in Secs. 12 and 13, T. 5 S., R. 17 E., M. D. M., on the Mariposa Grant, 12 miles by wagon road from Bagby. The vein averages 3 feet in width and has slate walls. The development consists of a 300-foot shaft, 550-foot adit level, 870 feet of drifting, crosscut 200 feet long and about 250 feet of raises. There is one stope 200 feet long and 200 feet high. The equipment consists of a hoist, bucket, water skip, 2 machine drills, compressor, 2 pumps and an air receiver. The mine is under lease at present and power is supplied from the Princeton mine.

Guadaloupe Quartz Mine. Consists of one patented claim owned by the Mariposa Commercial and Mining Company and located on the Mariposa Grant in Sec. 32, T. 5 S., R. 18 E., M. D. M., 17 miles by wagon road from Bagby. The average width of the vein is 18 inches and the walls are granite. The development consists of a 250-foot tunnel, but could not find out what had been done in the way of drifting. The mine has no equipment and has not been worked by the company for years. Two leasers are now working the property.

Guest Quartz Mine. Consists of one claim on unpatented farm land and is owned by J. W. Guest, located in Sec. 35, T. 4 S., R. 16 E., M. D. M. The vein is 2 to 8 inches wide in slate walls. There s a shaft 50 feet deep and the equipment consists of a gas engine hoist, one ore car, skip and a pump. Only assessment work is done.

Herman Quartz Mine. Consists of two unpatented claims owned by George Herman of Mariposa and located in Sec. 29, T. 4 S., R. 18 E., M. D. M. The vein is said to average 10 feet in width and to have porphyry walls. The development consists of a tunnel, 210 feet of drifts, one shaft 30 feet deep and an air shaft 150 feet deep. Only a windlass and bucket comprise the equipment. Only assessment work s being done.

Hite Mine. Consists of one placer and 15 quartz claims owned at present by J. S. Spellman of 244 Kearny street, San Francisco, and ocated in Sec. 27, T. 3 S., R. 19 E., M. D. M. The veins average 4 feet in width and are in diorite hanging-walls and footwalls. The development consists of a shaft 330 feet deep and there are three levels and nine adit levels. The total drifting could not be obtained. There are some winzes and raises and a stope 800 feet long by 100 feet high. Most of the $2,000,000 taken from this mine has been extracted from near the surface. The equipment consists of an air hoist, several machine drills, air compressor, drill steel, skip, station pump, 10-stamp mill, 3 tables, Challenge feeders, 2 amalgamating plates and a cyanid plant. The mine has been closed down since 1882. There are several buildings; in fact, the mine is thoroughly equipped and also has a flum 500 feet long and takes water from the south fork of the Merced River Idle at present and a caretaker on the property.

Hite Gold Mine on the south fork of the Merced River, Mariposa County, California.

Josephine Quartz Mine. Consists of one patented claim owned b the Mariposa Commercial and Mining Company and located on th Mariposa Grant in Sec. 16, T. 4 S., R. 17 E., M. D. M., 3 miles b wagon road to Bagby. The vein averages 6 feet in width and has slat walls. The development consists of a shaft 500 feet deep, 2518 feet o drifts, 710 feet of crosscuts, 400 feet of raises and a stope 500 feet long and 200 feet high.

The equipment consists of three mine cars, compressor, drills, drill steel, blacksmith shop, 30 h.p. motor; in fact, a complete mine equipment with buildings and hydroelectric power from their plant on the Merced River. Leasers are now working the mine. This mine is one of the largest belonging to this company.

Kane Quartz Claim. Consists of one unpatented claim, formerly called the Mayflower, owned by C. N. Kane of Mariposa and located in Sec. 2, T. 5 S., R. 19 E., M. D. M., between the Mt. Buckingham and the Golden Eagle. There are two tunnels, 60 and 140 feet long, respectively, and a 30-foot winze. There is no equipment. Only assessment work is being done.

Kennedy-Milburn-Allerd Quartz Claims. Consists of three unpatented claims owned by C. L. Kennedy, W. H. Milburn and Lawrence Allerd of Mariposa and located on the south fork of Chowchilla River, 2 miles east of Indian Peak, one half mile south of Nelson's Cove and 12 miles from Raymond in Madera County. The vein has a northeast and southwest strike and is about 9 feet wide. There is no wagon road to the claims and the development consists of a 40-foot adit level. Only assessment work is being done. Located in May, 1914.

Landrum Quartz Mine. Consists of two unpatented claims owned by Simeon Landrum and located in Secs. 34 and 35, T. 4 S., R. 18 E., M. D. M., 6 miles by trail from Briceburg. The vein averages 2 feet in width and has a limestone and talc footwall and a porphyry hanging-wall. The development work consists of a shaft 90 feet deep and 825 feet of drifts. The equipment consists of a gas engine, bucket and windlass. There are two cabins and a blacksmith shop. Only assessment work is being done.

Little Bear Quartz Mine. Consists of one unpatented claim owned by Pete Gordan of Mariposa and located in Sec. 19, T. 4 S., R. 19 E., M. D. M., 26 miles by wagon road from Bagby. The vein averages 2 feet wide and has a slate footwall and granite hanging-wall. The development consists of a 12-foot shaft. There is a cabin on the proprty, but nothing else. Only assessment work is being done.

Live Oak Quartz Mine. Consists of three unpatented claims owned by George Trede of Briceburg and located in Sec. 16, T. 4 S., R. 18 E., M. D. M., one half mile by trail from Saxon Creek station on the Yosemite Valley Railroad. The vein is about 20 inches wide and has a greenstone footwall and a slate hanging-wall. The development consists of 4 shafts, 20, 30, 40, and 80 feet deep, respectively, and a crosscut unnel 200 feet long. The equipment consists of one half mile of ditch, 16-foot arrastra, 2-stamp mill, Pelton wheel, blacksmith shop, tools, boarding house, bunk house and gravity tramway. The mine is not working at present.

London Quartz Mine. Consists of one claim, unpatented, owned by Albert Austin and L. E. Austin of Whitlock and located in Sec. 30, T. 4 S., R. 18 E., M. D. M., 25½ miles by wagon road from Bagby. The vein has an average width of 22 inches and the walls are porphyry. The ore is base, carrying copper with the gold values. The development work consists of a 30-foot incline shaft and a 16-foot drift. Only a windlass and wheelbarrow comprise the equipment. The owners are working at present.

Long Mary Quartz Mine. Consists of patented land on the Mariposa Grant owned by the Mariposa Commercial and Mining Company and located in Sec. 17, T. 5 S., R. 17 E., M. D. M., 14 miles by wagon road from Merced Falls. The vein is 2 feet wide with slate walls. The development consists of a 413-foot shaft, 1480 feet of drifts, drain tunnel 263 feet long, and 905 feet of raises. There is one stope 350 feet long by 400 feet high. The equipment consists of a hoist, 50 h.p. boiler, headgear, blacksmith shop, 5-stamp mill, rock crusher, Challenge feeder, two Union tables and an amalgamating plate. Not working at present.

Louis Quartz Mine. Consists of one patented claim owned by the Mariposa Commercial and Mining Company and located in Sec. 11, T. 5 S., R. 17 E., M. D. M., 12 miles by wagon road from Bagby. The vein averages 4 feet in width and has slate walls. The development consists of a 400-foot shaft, 924 feet of drifts, adit level 350 feet long, 115-foot crosscut, 150 feet of raises and a 30-foot winze; also a stope 80 feet long. There is no equipment on the property at the present and the property is idle.

Louisa Quartz Mine. Consists of one unpatented claim owned by August Revel and Eli Revel of Sweetwater and located in Sec. 27, T. 4 S., R. 19 E., M. D. M., 6 miles by trail from South Fork station on the Yosemite Valley Railroad. The vein is 4 feet wide between granite walls. The development consists of a 16-foot shaft and some trenches on the surface. There are also two adit levels 50 and 60 feet long, respectively. There is no equipment and only assessment work is being done.

Louise Quartz Mine. Consists of claims owned by the Merced Mining Company of Boston, Mass., and located in Sec. 4, T. 3 S., R. 16 E., M. D. M., in the Coulterville mining district. There are three levels and a vertical shaft 375 feet deep, 850 feet of drifts, 775 feet of crosscuts, 150-foot air shaft, 600 feet of winze. This mine has been idle for a number of years and not much information could be found about it.

Lovely Rogers Quartz Mine. Consists of one patented claim and one unpatented claim owned by Shimer Brothers of Coulterville and located in Sec. 11, T. 3 S., R. 17 E., M. D. M., 16 miles by road from Bagby. The vein is 2 feet wide in slate walls. The development consists of a 100-foot shaft and 3 adit levels, 400, 300, and 250 feet long, respectively; also a 70-foot crosscut and a winze 80 feet deep. There is one stope 200 feet long and 80 feet high. There is no equipment. Only development work is being done.

Malivina Quartz Mine. Consists of one claim belonging to the Merced Gold Mining Company of Boston, Mass. The development consists of a vertical shaft 1000 feet deep, one incline shaft on the vein 875 feet deep, 2287 feet of drifts and 1225 feet of crosscuts. The milling is done on the adjoining Potosi mine owned by the same company. The equipment consists of a hoisting engine and building and head frame. The ore was trammed by mule team to the Potosi mill. Idle at present.

Malone Quartz Mine. Consists of five unpatented claims owned by the Golden Wreath Mining Company of San Francisco and located in Sec. 5, T. 5 S., R. 19 E., M. D. M., 28 miles by wagon road from Bagby. The vein ranges in width from 3 inches to 1 foot, between granite walls. The development consists of a 150-foot shaft, 600 feet of drifts, one adit level and a 600-foot crosscut tunnel. There is a stope 300 feet long, and 90 feet high. The equipment consists of a skip, 20 h.p. engine, 25 h.p. hoist engine, 80 h.p. boiler, 10-stamp mill, Golden State rock crusher, 2 Challenge feeders and 2 amalgamating plates. There is a dwelling house, blacksmith shop, boarding house, and bunkhouse. The mine had just started its plant at the time it was visited.

Mariposa Quartz Mine. Consists of one patented claim owned by the Mariposa Commercial and Mining Company of San Francisco and located in Sec. 23, T. 5 S., R. 18 E., M. D. M., 16 miles from Bagby by wagon road. The vein averages 5 feet in width and is in diabase walls. The development consists of a 1550-foot shaft, 5757 feet of drifts on the 8 levels, 800 feet of crosscuts, 1000 feet of raises and about 100 feet of winzes. All the ground is stoped from the eighth level to the surface with a width of 500 feet. The equipment consists of a reduction plant, namely, 5-stamp mill, Challenge feeder, 4′ x 12′ plate, compressor, hoist, one 75 h.p. and one 10 h.p. motor, blacksmith shop, machine shop, tools and machine drills. All underground equipment has been removed to the surface as the mine is caving. When the mine was visited a roasting furnace and cyanide plant was being completed to treat some concentrates lying on the mine. This plant is to be operated by leasers. The mine is idle and formerly used to be one of the large producers of the county.

Mary Harrison Quartz Mine. Consists of one claim owned by the Merced Gold Mining Company of Boston, Mass., and located in Secs. 10 and 11, T. 3 S., R. 16 E., M. D. M., 9 miles from Pleasant Valley by wagon road. The vein averages 2 feet in width and lies between slate walls. The development consists of a 1200-foot shaft; on the 12 levels there are 4800 feet of drifts, 700 feet of crosscuts, an incline shaft 600 feet deep, 540 feet of winzes and some raises that have been stoped out. There are many stopes of various dimensions. The equipment consists of a fine boiler house with boilers, engine house and hoisting engine, stone office building, storehouse and all kinds of machinery parts and hardware, also rock crusher and bins. The ore was crushed and hauled by tram over a narrow gauge track to the Potosi mill which is owned by the same company. This property, which was formerly one of the large producers of the county, has not been worked for some years. A caretaker remains on the property.

Mebold Quartz Mine. Consists of one unpatented claim owned by Fred Mebold of Jerseydale and located on Sweetwater Creek, northwest of the Sweetwater mine. It has a 50-foot crosscut tunnel and a few feet of drifts. The vein is 2 feet wide and in granite walls. Not working at present.

Merced River Quartz Mines. Consists of 13 unpatented claims owned by R. A. Keller and the James Burns Company and located in Secs. 15, 16 and 22, T. 3 S., R. 16 E., M. D. M., one half mile from the Yosemite Valley Railroad. The vein is from 1 to 4 feet in width. The development consists of a 100-foot shaft with two levels and 210 feet of drifts. Another shaft is 90 feet deep. There is one crosscut 230 feet long. The equipment consists of a 10-stamp mill which is not erected, 2 rock crushers, 25 h.p. gas engine, boarding house, bunk house, and dwelling house. Not working at present.

Mocking Bird Quartz Mine. Consists of one patented claim owned by J. A. Schroeder and C. J. Schroeder of Mariposa and located in Sec. 27, T. 4 S., R. 18 E., M. D. M., 20 miles by wagon road from Bagby. The vein averages 3 feet in width, with porphyry footwall and slate hanging-wall. The development consists of a 100-foot shaft and 100 feet of drifts. Blacksmith shop, drill steel, bucket, windlass and cabin complete the equipment. Only in a prospect condition and a little work is done each year.

Monte Cristo Group. Consists of four unpatented claims owned by F. M. Skilton and L. C. Worthington of Jerseydale and located in Sec. 20, T. 4 S., R. 20 E., M. D. M., 13 miles by wagon road and trail from the forks of Merced River and 3 miles by trail from the Comet mine. The quartz vein averages 6 feet wide, as far as opened up, and carries some arsenic and antimony with the values. There are: 65-foot incline shaft and several open cuts in the way of development, but there is no equipment outside of a cabin, blacksmith forge, windlass and bucket. This property was idle at the time it was visited but an examination had been made and the engineer took his report to New York to try to sell the property.

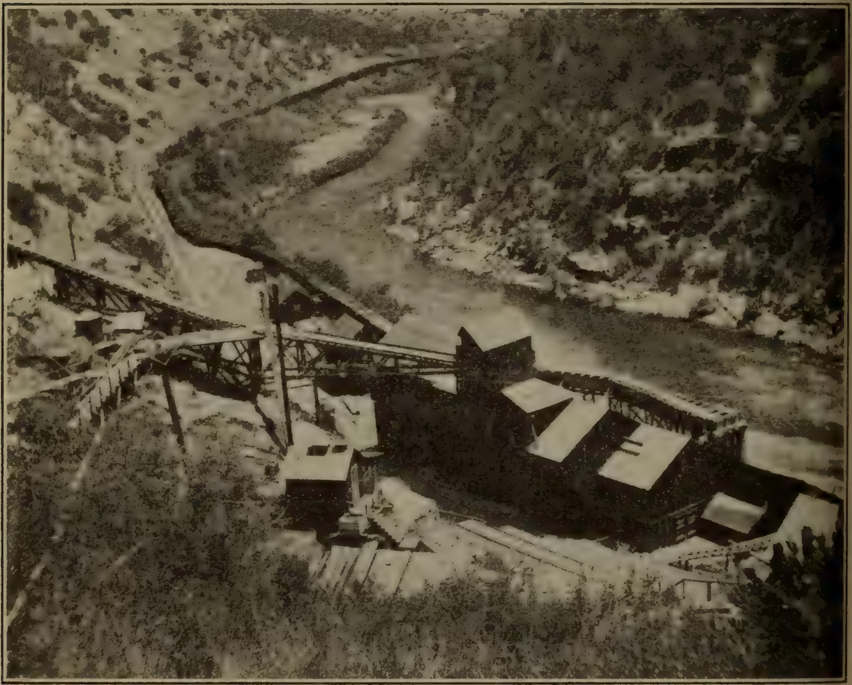
Mountain Belle Quartz Mine. Consists of one patented claim owned by J. P. Crichton of San Francisco and located in Sec. 25, T. 5 S., R. 17 E., M. D. M., 14 miles by wagon road from Bagby. The vein averages 3 feet wide in quartz porphyry walls. The development includes a 174-foot incline shaft and 100 feet of drifting on the two levels. The equipment consists of a 10 h.p. gasoline engine, an amalgamating plate 4′ x 10′, one Union concentrator, 15 h.p. gasoline engine for the mill drive and a Blake rock crusher. The buildings include a boarding house. Nothing has been done on the claim since 1908.

Mt. Buckingham Group. Consists of eight quartz claims, 2 mill sites and 169 acres of timber land. Twenty acres of the quartz claims are patented and the 169 acres of timber are also patented. These claims are owned by the Mt. Buckingham Gold Mining Company of Mariposa and are located in Secs. 1, 2, 11 and 12, T. 5 S., R. 19 E., M. D. M., 13 miles from Briceburg by wagon road. There are five contact veins with granite footwall and slate hanging-wall and the widths range from 2 feet to 10 feet. The development consists of a 500-foot crosscut tunnel, 250-foot raise and 30-foot winze. There are two stopes—one 40 feet long by 200 feet high and the other 60 feet long and 200 feet high. The equipment consists of three mine cars and hand drill steel. Not working but expect to begin soon. J. L. Diven in charge.

Mt. Gaines Quartz Mine. Consists of 14 claims owned by A. R. Maines, 439 Kingsley drive, Los Angeles, and located in Sec. 35, T. 4 S., R. 16 E., M. D. M., 14 miles by wagon road from Merced Falls. The vein pinches and swells into various widths and lies between diorite walls.

The development consists of an incline shaft 1350 feet long with 11 levels and 7840 feet of drifts and 250 feet of raises. There are two large stopes—one 340 feet long by 550 feet high and several smaller ones of irregular shapes. The equipment consists of a power line from the San Joaquin Power and Light Company's line to the property, hoisting equipment by air or steam, 2 boilers, one 10-machine compressor, 9 machine drills, pipe, skip, 5 pumps, including sinking pump, 20-stamp mill, rock crusher, Challenge feeders, 4 amalgamating plates and 8 concentrators. There are also blacksmith shop, store room, office, cook house, 2 bunk houses, assay office, 4 cabins, transformer house, sulphuret house, boiler house, compressor building, 4 cottages and superintendent's house. The mine closed down in 1910 and has not worked since.

Mountain King Quartz Mine. Consists of 12 claims owned by the Mountain King Mining and Milling Company of 244 Kearny street, San Francisco, and located on the north bank of the Merced River on the Yosemite Valley Railroad in Sec. 31, T. 3 S., R. 18 E., M. D. M. The veins of quartz and slate average 5 feet in width and lie between slate walls. The development consists of 5 levels with 5200 feet of drifts, 1550 feet of crosscuts, 70 feet of winzes and 700 feet of raises. There is also a stope 200 feet long by 600 feet high.



Mountain King Mine, mill and ditch line on the Merced River, Mariposa County, California.

The equipment consists of 10 ore cars, 4 machine drills, drill steel, blacksmith shop, timber shed, 34-stamp mill, Blake crusher, 2 amalgamating plates, 2 Challenge feeders, 6 Standard tables, flume 1000 feet long, 2 Victor turbines, Rix compressor, Gould triplex pump, office, bunk house, cook house, change house, assay office, foreman's office, superintendent's office and residence, and surface tramway. Ten stamps were working and 26 men were employed and 75 horsepower was being developed on the river in their power plant.

Mt. Ophir Quartz Mine. Consists of one patented claim located on the Mariposa Grant in Sec. 12, T. 5 S., R. 18 E., M. D. M., and owned by the Mariposa Commercial and Mining Company. It is 10 miles by wagon road from Bagby. The vein averages 5 feet in width and lies between a serpentine footwall and a slate hanging-wall. The development consists of three adit levels with 1500 feet of drifts, 360 feet of raises, 80 feet of crosscuts and 20 feet of winze. There is a stope 200 feet long and 300 feet high. There is not very much equipment on the property other than the track and ore car. The high voltage power line from Bagby passes over the property. It was closed down in 1910 and some leasing has been done but is idle now.

Ruins of what is said to have been the first mint in California, at Mount Ophir, on the Mariposa Estate. Fifty-dollar slugs were minted here.

Mt. Queen Quartz Claims. Consists of two unpatented claims owned by Daniel E. Johnson of Mariposa and located in Sec. 29, T. 4 S., R. 18 E., M. D. M., in the Whitlock mining district. The vein averages 2 feet in width. There are five shafts, three of them being 85 feet, 60 feet, and 45 feet in depth. There is a cabin and a windlass on the claims. The claims are under bond to the Mariposa Mines and Development Company.

Mountain View Quartz Mine. Consists of one patented claim owned by the Mariposa Commercial and Mining Company and located on the Mariposa Grant in Sec. 11, T. 5 S., R. 17 E., M. D. M., 10 miles by wagon road from Bagby. The vein averages 2½ feet in width and lies between slate walls. The development consists of two adit levels with 500 feet of drifting, 400 feet of crosscuts, 160 feet of raises and one stope, 50 feet long and 100 feet high. No equipment except the track. The ore was hauled to the Princeton mill by wagon. The mine has been closed for about a year. Was worked by leasers.

Number One Quartz Mine. Consists of one full claim owned by the Treasure Gold Mining Company of Hornitos and located in Secs. 34

and 35, T. 4 S., R. 16 E., M. D. M., 15 miles by wagon road from Merced Falls. The vein averages 3 feet in width with a slate footwall and diabase and porphyry hanging-wall. The development consists of a 360-foot shaft, three levels with 1150 feet of drifts, 130-foot crosscut and three stopes. The equipment consists of an electric hoist, 20-h.p. motor, skip, 2000 feet of rails, blacksmith shop, 10-stamp mill, 2 compressors, 2 motors, Challenge feeders, 2 amalgamating plates, 3 concentrators and a Johnson rock crusher. The buildings include a hoist building, assay office, store house, office and several small buildings. Power from the San Joaquin Power and Light Company. The mine has just been reopened.

Number Five Quartz Mine. Consists of two full claims and a half, unpatented, and owned by the Nevada Mineral Extraction Company of Berkeley, Cal., and located in Sec. 10, T. 5 S., R. 16 E., M. D. M., 13 miles by wagon road from Merced Falls. The vein of quartz varies from 17 to 30 feet in width and has a diorite footwall and a slate schist hanging-wall. The development consists of a 260-foot shaft, 110 feet of drifts, and a 427-foot crosscut. The equipment consists of an electric hoist, Gardner compressor, 35 h.p. motor for compressor, 40 h.p. motor for hoist, 2 machine drills, 100 feet of mine rails, bucket, blacksmith shop, Cameron sinking pump, duplex Fairbanks pump, Parker Linn ball crusher and Parker Linn ball pulverizer, Parker amalgamating machine and 3 motors for crushers and grinders. The amalgamating plates are treated by chemicals before mercury is used on them. Mine was being equipped at time it was visited. The buildings include assay office, transformer house, and small buildings.

Ore bins, crushing plant and amalgamating plant of the Number 5 Gold Mine, Hornitos mining district, Mariposa County, California.

Old Wilcox Quartz Claim. Consists of one unpatented claim owned by A. H. Ward of San Francisco and located in Sec. 18, T. 3 S., R. 19 E., M. D. M., on the north bank of the Merced River. The vein lies between a granite footwall and slate hanging-wall. The development consists of a shaft that is supposed to be 110 feet deep and a tunnel 75 to 80 feet long. The claim has not been worked since 1862 and has no equipment.

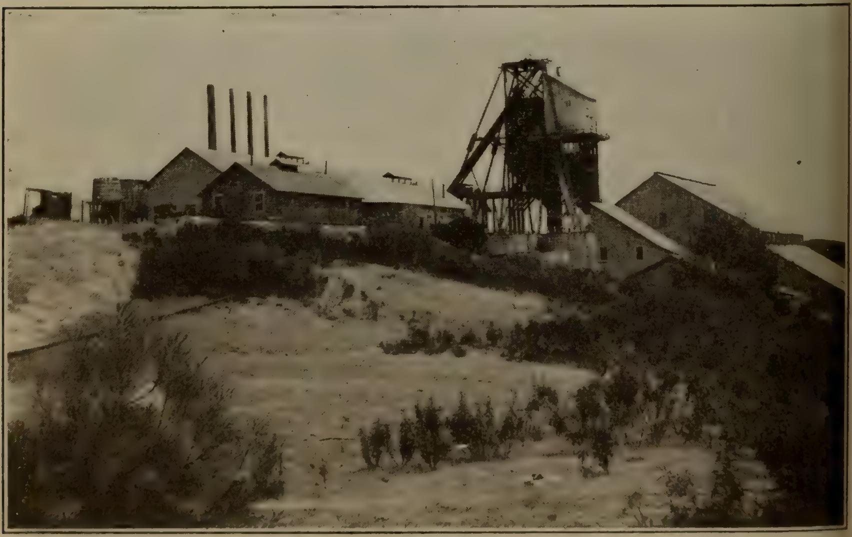
Original Quartz Mine. Consists of four unpatented claims owned by the Original Mining and Milling Company of Merced, Merced County, and located in Sec. 21, T. 3 S., R. 19 E., M. D. M. The vein averages 2 feet in width between slate walls. The development consists of a 640-foot shaft, 4 levels with 2053 feet of drifts, 185-foot crosscut, 485 feet of raises, a winze 462 feet deep and three stopes. The equipment consists of a hydroelectric plant on the Merced River which has a Westinghouse 133 k.w. generator, 100 h.p. Ingersoll Rand air compressor, one 30-inch and one 20-inch Pelton wheel, undershot and low pressure. The ditch and flume are 3400 feet long and carry 6000 inches of water at 34-foot head. An electric hoist (30 h.p.), one skip, 3000 feet of 12-pound mine rails, 1500 feet of 8-inch ventilating pipe, 2-inch compressed air pipe, 10 machine drills, drill steel, etc., are also included in the plant.

The reduction equipment includes a 10-stamp mill, Blake rock crusher, 2 Challenge feeders, two 4′ x 6′ plates and three Gates vanners. The buildings include an office, 2 bunk houses, dining room, change room, assay office, blacksmith shop, concentrate house, 8 small residences, and 7 small tent houses. The mine and mill are lighted by electricity. About 40 men are employed at present.

Orra Rica Quartz Mine. Formerly called the Peñon Blanco, consisting of five patented claims owned by J. C. Wilson and associates of San Francisco and located in Sec. 20, T. 2 S., R. 16 E., M. D. M., about 7 miles by wagon road from the town of Coulterville. The vein is from 3 to 6 feet in width and has a slate footwall and diorite hanging-wall. The development consists of a tunnel 2050 feet long and some drifts. Very little information was to be had as the mine is in litigation and all information was withheld.

Pine Tree Quartz Mine. Consists of one patented claim located on the Mariposa Grant in Sec. 9, T. 4 S., R. 17 E., M. D. M., 3 miles by wagon road from Bagby and owned by the Mariposa Commercial and Mining Company. The vein averages 10 feet in width and has a slate footwall and serpentine hanging-wall. The development consists of a 380-foot shaft with 4 levels and 400 feet of drifts, 133 feet of crosscuts, 700 feet of raises; the pay shoot is stoped for a length of 500 feet and to a height of 500 feet. The equipment consists of a 5-stamp mill called the Benton mill located on the Merced River at Bagby, 2 Union tables and two 20 h.p. motors. The ore is mined and hauled by wagon to Bagby. The mill has a Dodge crusher, Challenge feeder, amalgamating plate 5′ x 20′. The mine is now being worked by leasers.

Potosi Quartz Mine. Consists of one patented claim owned by the Merced Gold Mining Company of Boston, Mass., and located in Sec. 4, T. 3 S., R. 16 E., M. D. M., 9 miles by wagon road from Pleasant Valley on the Yosemite Valley Railroad. The vein is from 3 to 20 feet wide and has slate walls. The development consists of a shaft and 9 levels, 2500 feet of drifts, 2 air shafts, 50 feet of crosscut, 25-foot raise and a stope 100 feet long. The equipment is quite extensive and includes a power line of the Pacific Gas and Electric Company from the Orra Rica quartz mine, 11,433 feet long and a large motor not set up. There are also 3000 feet of track, shaft pump, ore cars and 2 rock crushers, 40-stamp mill, 16 Union Iron Works vanners, eight 4′ x 16′ amalgamating plates, Challenge feeders, blacksmith and machine shop with complete set of lathes and tools, boiler house and 4 boilers, compressors, hoisting engine, mill engine and engine for rock crusher. There are about 4 miles of narrow gauge track from the Mary Harrison mine to the Potosi mill, one 8-ton locomotive, twelve 3-ton ore cars, transformer house, change house, cook house, office, assay office, and several small buildings. The shaft was unwatered as far as the ninth level in 1912, when work ceased and the mine has been idle since.



Princeton Quartz Mine plant, belonging to the Mariposa Commercial and Mining Company of Mariposa County, California.

Princeton Quartz Mine. Consists of one patented claim owned by the Mariposa Commercial and Mining Company of San Francisco, and located on the Mariposa Grant in Sec. 18, T. 5 S., R. 18 E., M. D. M., 12 miles by wagon road from Bagby. The vein averages 8 feet wide and has slate walls. The development consists of an incline shaft 1660 feet long with 8 levels, 11,418 feet of drifts, 1827 feet of raises and 1300 feet of crosscuts. The shoot is stoped from the 1200-foot level to the surface. All underground equipment has been removed from below. There is a 40-stamp mill, Challenge feeders, amalgamating plates, Union tables, machine shop, blacksmith shop, carpenter shop, assay office, store, saw mill, change house, five 50 h.p. boilers, machine drills and tools, powder magazine and transformer house, two 150 h.p. and one 100 h.p. compressors, three motors, Snow duplex pump, and a Cameron sinking pump. The mine is fully equipped but idle at present.

Quail Quartz Claims. Consist of four unpatented claims located in Sec. 16, T. 3 S., R. 17 E., M. D. M., in the California mining district, 9 miles by wagon road from Bagby. The vein averages 4 feet wide and has slate walls. The development consists of a shaft, one adit level, 600 feet of drifts, 3 raises and a stope 200 feet long by 70 feet high. The equipment consists of 900 feet of rails, 3 ore cars, Park and Lacey duplex compressor, hoist and blacksmith shop. There are also 10-stamp mill, 2 rock crushers, 40 h.p. engine and 50 h.p. Nagle boiler. Not working at present.

Recorder Quartz Mine. Consists of one unpatented quartz claim owned by Frank Armstrong and Isaac Miller of Briceburg and located in Sec. 28, T. 4 S., R. 18 E., M. D. M., 22 miles by wagon road from Bagby. The vein averages one foot in width and lies between porphyry walls. The development consists of one adit level with 200 feet of drifting. There is a cabin on the mine. Only assessment work is done.

Reed Quartz Claim. Consists of a quartz ledge located on 154 acres of patented farm land in Secs. 28 and 33, T. 2 S., R. 16 E., M. D. M., and owned by Mrs. J. W. Reed. Only small prospect holes have been sunk.

Revel Quartz Mine. Consists of one unpatented claim owned by August Revel and Eli Revel of Sweetwater and located in Sec. 28, T. 4 S., R. 19 E., M. D. M., 6 miles by trail from North Fork station on the Yosemite Valley Railroad.

The vein averages 2 feet in width and lies between granite walls. The development consists of a 150-foot shaft, one level with 700 feet of drifts, 30-foot crosscut and a stope 800 feet long and 150 feet high. There is one ore car and some track on the property. The property is not working at present. The drifts have caved.

Roma Quartz Mine. Owned by the Harris Estate and situated in Sec. 14, T. 4 S., R. 18 E., M. D. M. The vein is 2 feet wide and there is a 1000-foot tunnel. It closed down 25 years ago and very little information could be found about it.

Royal Group. Consists of six unpatented claims and a fraction owned by Tresidder, Bains and Tresidder of Mariposa and located in Sec. 29, T. 4 S., R. 18 E., M. D. M. There are a shaft 75 feet deep, 200 feet of drifts and a 30-foot winze. The vein ranges from an inch to 18 inches in width and lies in porphyrite formation. Only assessment work is done.

Rutherford Quartz Mine. Consists of one patented claim owned by A. H. Ward of San Francisco and located in Sec. 22, T. 3 S., R. 19 E., M. D. M. The vein is 4 feet wide and the development consists of a 460-foot adit level and an 80-foot raise, also a stope 60 feet long by 80 feet high. There is no equipment on the property and no work has been done for 20 years.

Ruth Pierce Quartz Mine. Consists of two claims on patented agricultural land owned by the Hornitos Gold Mining Company of 127 Montgomery street, San Francisco, and situated in Sec. 13, T. 5 S., R. 16 E., M. D. M., 4 miles by wagon road from Hornitos. The vein averages about 3 feet in width and the development consists of a 550-foot shaft, part vertical and part incline, with 6 levels and 2272 feet of drifts. There is one stope 330 feet long by 375 feet high. The equipment consists of a 15 h.p. gasoline hoist, skip, mine track, boiler, 4-machine compressor, 4 machine drills, blacksmith shop, 10-stamp mill, Challenge feeders, two amalgamating plates 5 feet wide by 16 feet long, and two Frue vanners. The mine was taken over by the present company in May, 1913, and is now being put in shape to develop.

San Domingo Quartz Mine. Consists of one unpatented claim owned by Wm. Zeller of Escalon, near Stockton, and located in Sec. 13, T. 4 S., R. 18 E., M. D. M., 29 miles by wagon road from Bagby. The vein is 2 feet wide and has a slate footwall and a granite hanging-wall. The equipment consists of a 400-foot tunnel, 180-foot air shaft, several winzes and some raises. There are 180 feet of mine rails, one ore car, drill steel and a blacksmith shop. Only assessment work is being done.

Schroeder Group. Consists of 4 quartz claims and one placer claim owned by J. A. Schroeder, P. W. Judkins and C. H. Weston and located in Sec. 16, T. 4 S., R. 18 E., M. D. M., 2 miles by trail from Saxon Creek station on the Yosemite Valley Railroad. The vein varies from a few inches to 3 feet in width, and has porphyry footwall and slate hanging-wall. The development consists of an open cut 200 feet long and 30 feet deep and 375 feet of drifts. The equipment consists of

300 feet of track. 4 ore cars, blacksmith shop, and derrick. This is only a prospect and some work is now being done.

Sierra Rica Quartz Mine. Consists of two claims, one of which is patented, owned by M. A. Wilson and J. M. Graham of San Jose, located in Sec. 14, T. 4 S., R. 18 E., M. D. M., 24 miles by road from Bagby. The vein averages 1½ feet in width and has porphyry footwall and slate hanging-wall. The development consists of a 300-foot tunnel on one claim and a 100-foot tunnel on the other, one 125-foot raise and one 60-foot raise. The equipment consists of 2 mine cars, tools, drill steel and a blacksmith shop. There are 4-stamp mill, Challenge feeders, rock crusher and one amalgamating plate 4 feet by 8 feet. There are two miles of ditch, one boiler and engine, a boarding house and two dwellings. Not worked at present.

Silver Lead Quartz Mine. Consists of three patented claims owned by the Mariposa Mining and Milling Company of Carson, City, Nev., and located in Sec. 34, T. 4 S., R. 16 E., M. D. M., 12 miles by wagon road from Merced Falls. The development consists of a 240-foot shaft and 422 feet of drifts. The equipment consists of an air hoist, compressor, 75 h.p. motor, sinking pump, gas engine, 5-stamp mill, rock crusher, Challenge feeder, one 4′ x 16′ amalgamating plate, 2 concentrators and two small motors—one 10 h.p. and the other 20 h.p. There is a boarding house, blacksmith shop, and a barn on the mine. Twelve men were being employed at the time the mine was visited.

Spencer Quartz Mine. Consists of a patented fraction of a claim owned by Ada Harris and located in Sec. 29, T. 4 S., R. 18 E., M. D. M., 23 miles by wagon road from Bagby. The vein averages 5 feet in width and has a diorite footwall and slate hanging-wall. The development consists of a 150-foot shaft, air shaft 150 feet long, 500 feet of drifts, 220 feet of crosscut, 50-foot winze, and a stope 350 feet long and 150 feet high. The equipment consists of one ore car, hand pump, drill steel and blacksmith shop. The mine is under bond to the Mariposa Mining and Development Company for six months.

Spread Eagle Quartz Mine. Consists of two unpatented claims owned by Nick Mullins of Whitlock and located in Sec. 32, T. 4 S., R. 18 E., M. D. M., 19 miles by wagon road from Bagby. The vein averages 2 feet in width and has porphyry walls. The development consists of a 210-foot shaft with 2 levels and 1800 feet of drifts. Adit level is 1000 feet long. There are one 200-foot crosscut, some winzes and raises, also some old stopes. The equipment consists of 2000 feet of mine rails, 2 ore cars, hand drills and 2 blacksmith shops. The mine is being leased.

Squirrel Mine (see *Bunker Hill*).

Stockton Creek Quartz Mine. Consists of one patented claim owned by the Mariposa Commercial and Mining Company and located in Sec. 24, T. 5 S., R. 18 E., M. D. M. The vein is about 2½ feet wide with diabase walls. The development consists of a 135-foot incline shaft with 2 levels and 550 feet of drifts and a stope 100 feet long by 70 feet high. The equipment includes a hoist, 5 h.p. dynamo, 200 feet of mine rails and a blacksmith shop. Not working at present.

Stud Horse Flat Group. Consists of three unpatented claims and a millsite owned by John P. Carroll of Bagby and located in Sec. 35, T. 3 S., R. 16 E., M. D. M., 3 miles from Bagby by trail. The vein is from 3 to 6 feet wide and has a slate footwall and porphyry and diorite hanging-wall. The development consists of a 150-foot shaft with 2 levels and 300 feet of drifts, 70 feet of old shafts and 80 feet of tunnels and a stope 250 feet long and 60 feet high. The equipment consists of a 5-stamp mill which has not yet been set up. Three men are employed sinking.

Sunshine Group. Consists of five quartz claims and one placer claim owned by Mrs. J. L. Divens, 147 Kempton avenue, Oakland, and located in Secs. 19 and 20, T. 4 S., R. 18 E., M. D. M. The veins vary from 1 foot to 3 feet in width and have poryhyry footwall and slate hanging-wall. The development consists of a 100-foot incline shaft, 280 feet of drifts, a 100-foot raise and a stope 140 feet long which is stoped to the surface. The equipment consists of 380 feet of mine rails, two skips, one mine car, drill steel and tools, gasoline hoist, 200-ton ore bin, and one Chilian mill. The power is from steam supplied from an adjoining mine. The mine is under bond to the Mariposa Mines and Development Company and not working at present.

Sweetwater Quartz Mine. Consists of seven quartz claims owned by the Midway Mining and Milling Company and located in Secs. 17 and 20, T. 4 S., R. 19 E., M. D. M., 38 miles by wagon road to Bagby. The vein averages 2½ feet wide and has granite walls. The development consists of a 100-foot shaft, 1500 feet of drifts, 240 feet of raises, one 6-foot winze, 600-foot crosscut tunnel and four stopes of various sizes. The equipment consists of 2300 feet of mine track, 2 iron skips, Cameron pump, 1 Blake rock crusher, Cornish rolls, 10-stamp mill, 2 amalgamating plates 4′ x 16′, two Johnson vanners, 1 Standard table, 1 Pindar table, 1 compressor, 2 boilers, 4 machine drills, boarding house, blacksmith shop, concentrate house and bunkhouse. The mine is bonded to J. L. McAllister and Mrs. E. McKeith and no work is being done at present.

Tyro Quartz Mine. Consists of one patented claim, the owner of which is unknown, and located in Secs. 9 and 10, T. 3 S., R. 16 E.,

M. D. M. The vein is 2 feet wide and has slate walls. The development consists of a 700-foot shaft, with 6 levels and 1370 feet of drifts, a 60-foot raise and a stope 80 feet long by 700 feet high. The equipment includes 1 skip, Cornish pump, Cameron steam pump, 10-stamp mill, rock crusher, 2 Challenge feeders, 2 amalgamating plates, 4′ x 12′, 3 Frue vanners, 2 boilers, 8 h.p. each, steam hoisting engine for mill, blacksmith shop, caretaker's house and a large oil tank and water tank. The mine is idle at present.

Virginia Quartz Mine. Consists of four claims, one of which is patented, owned by the White Gulch Mining Company of 263 Twelfth street, Oakland, and located in Secs. 13 and 18, T. 3 S., R. 16 E., M. D. M., 8 miles by wagon road from Bagby. The vein varies from a seam to many feet and has a serpentine footwall and diabase hanging-wall. The development consists of a 650-foot shaft with four levels and 250 feet of drifts, several crosscuts, about 350 feet of raises and 250 feet of winzes. There are two stopes—one 100 feet long by 150 feet high, and the other 100 feet long and 60 feet high. The equipment includes about 2000 feet of mine track, 2 ore cars, 700 feet of 3-inch compressed air pipe, 300 feet of 2-inch compressed air pipe, a Fairbanks-Morse hoist and 35 h.p. motor, 20 cubic foot skip, 200 feet of 2-inch pump column, 10-stamp mill, 2 Challenge feeders, Blake rock crusher, 2 amalgamating plates and a 50 h.p. gas engine. There are also 50 h.p. Ingersoll-Rand compressor, 3 miles of power line, blacksmith shop, bunkhouse, timber shed, cookhouse, office, transformer house, and superintendent's house. The mine has been operated by this company since 1912 and employs 15 men. C. C. Powning, superintendent.

White Oak Quartz Claim. Consists of one unpatented claim owned by A. H. Ward of San Francisco, and located in Sec. 18, T. 3 S., R. 19 E., M. D. M. The vein is 2 feet wide and has a granite footwall and slate hanging-wall. The development consists of a shallow prospect shaft, one tunnel 450 feet long in granite. Has not been worked for twenty years.

Whitlock Group. Consists of three patented claims owned by Dr. Gallison and Lizzie Sain and located in Sec. 32, T. 4 S., R. 18 E., M. D. M., 18 miles by wagon road from Bagby. The vein is 4 feet wide between greenstone walls. The development consists of a shaft and four levels and 2115 feet of drifts, winze 140 feet deep and 400 feet of crosscuts. The Alabama claim has a shaft 300 feet deep. There are two stopes—one 150 feet long by 150 feet high, and the other 240 feet long and 300 feet high. The equipment includes 2000 feet of mine rails, 6 ore cars, 3 trucks, 3 air machines and steel, 20-stamp mill, rock crusher, Challenge feeders, air compressor, 50 h.p. hoist engine, 3 boilers, 4 amalgamating plates, 4 vanners, assay office, blacksmith shop, boarding house and superintendent's house. The mine was shut down in 1899 and leasers worked it for a time, but it is idle now.

GOLD (PLACER).

Placer mining in the county has dwindled to almost nothing and what little work is being done is very irregular and depends very extensively on the rainfall. One does not see the long ditch lines in this county such as are to be found in other counties, bringing water to the placer mines.

Ah Wai Drift Mine. Consists of one unpatented claim (placer) owned by John Hand and W. D. Weston of Mariposa and located in Sec. 32, T. 4 S., R. 18 E., M. D. M., 25 miles by wagon road from Bagby. The gravel is bench gravel with a rough slate bedrock with free wash and large boulders.

The development consists of 2000 feet of bedrock tunnel. The equipment consists of 2 miles of ditch, a reservoir 30 feet by 10 feet by 4 feet deep, sluice boxes, and pole and Hungarian riffles. There are cabin, blacksmith shop, drills and tools and one ore car. Works six months during the winter season.

Schroeder Placer Mine. Consists of one patented claim owned by J. A. Schroeder, C. J. Schroeder, P. W. Judkins and C. H. Weston and located in Sec. 16, T. 4 S., R. 18 E., M. D. M., 20 miles by wagon road from Bagby. These are bench diggings and the gravel is medium wash with some clay and boulders on a porphyry bedrock. The development consists of about 5 acres that have been washed off by ground sluicing with a canvas hose. A tunnel 50 feet long is being extended. The equipment consists of 3 ditch lines, having a total length of 5½ miles, 1500 feet of 8-inch pipe, sluice boxes and riffles. It is being worked each winter.

The Garden Placer Claim. Consists of one patented claim owned by W. D. Weston and located in Sec. 32, T. 4 S., R. 18 E., M. D. M., 25 miles by wagon road from Bagby. There are 20 acres of bench gravel which is small wash and is worked by ground sluicing during three months in the winter. The bedrock is slate. Pole and Hungarian riffles are used and the gold is fairly coarse.

GRANITE.

Granite abounds in large quantities in Mariposa County of the same variety as the famous granite at Raymond in Madera County, but it is so far from transportation that it is not able to compete at present with that more favorably situated. A granite property consisting of 50 acres of patented land located in Sec. 20, T. 6 S., R. 19 E., M. D. M., was located in 1906 by Guido Vignalo but was deeded to the State for taxes.

It is 15 miles by wagon road from Raymond and the granite is the same as that of the Raymond granite but is not being worked.

MARBLE.

There is a very fine marble located in Sec. 2, T. 4 S., R. 19 E., M. D. M., 6 miles southwest of El Portal on the road to Hites Cove and on the south fork of the Merced River. It is owned by F. A. Bondshu, J. F. Harris, C. P. Pratt and J. W. Pratt of Mariposa. The limestone is about 3000 feet wide and stands 600 feet from the river. The marble is white with dark streaks through it and takes a fine polish.

Croppings of white marble on the south fork of the Merced River near Hites Cove, Mariposa County, California.

MEERSCHAUM.

Meerschaum has been found on a copper claim just east of the town of Mariposa located in Sec. 30, T. 5 S., R. 19 E., M. D. M., and located by Thomas A. Schlagerty of Mariposa. The quantity is not very large but the quality is excellent.

PHOSPHORETIC ZINCBLENDE.

The Aposozein Manufacturing Company of 512 Mission street, San Francisco, owns 80 acres of grazing land in Secs. 9 and 10, T. 4 S., R. 15 E., M. D. M., upon which there is a ledge of schist containing phosphoretic zincblende which is being ground by the Natura Company of San Francisco and sold under the name of ''Akoz'' as a curative for various ailments. The rock has the peculiar property of imparting a glow when scratched with a knife or piece of steel.

QUICKSILVER.

There is a quartz ledge on the Merced River at Horseshoe Bar that has a north and south strike and carries crystallized cinnabar on the footwall side. It is not in sufficient quantity to be of commercial value but merely as a note of interest. See Geological Survey of California (Vol. 1) by Whitney for mention of it.

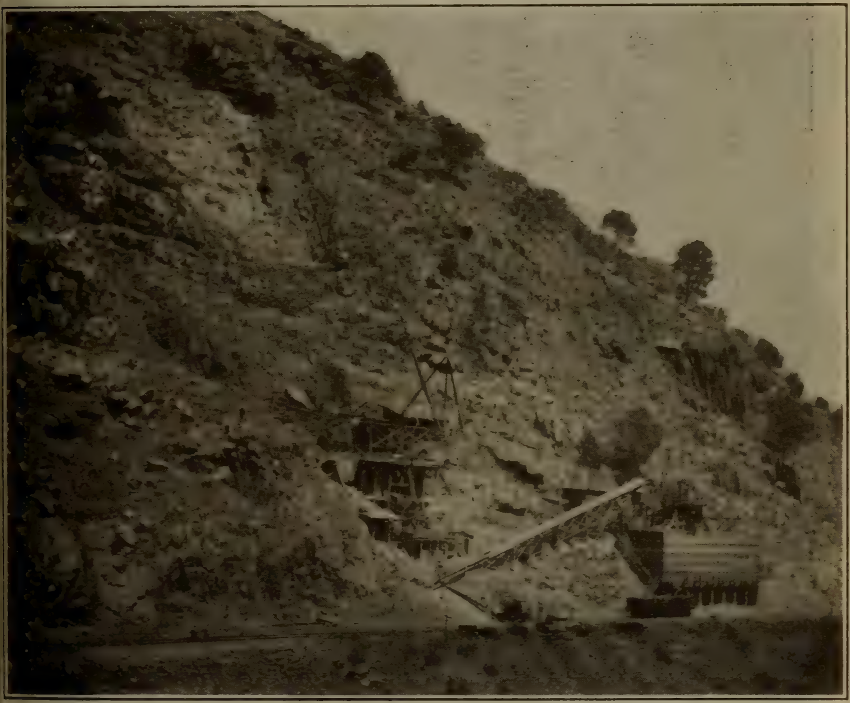
ROCK QUARRIES.

Yosemite Rock Quarry. This quarry consists of 80 acres owned by the Merced Stone Company and leased by the E. B. & A. L. Stone Company, Rialto Building, San Francisco. The quarry and plant are

Merced Stone Company's rock quarry at Jasper Point on the Merced River and the Yosemite Valley Railroad, Mariposa County, California.

located on the Merced River at Jasper Point in Sec. 19, T. 3 S., R. 16 E., M. D. M. The rock is an altered quartzite, very hard and of a jaspery nature. The equipment consists of a steam shovel, compressor and air drills, three gyratory crushers, screens, bucket conveyors, bins, electric motors, power line and transformer house. Power is obtained from the San Joaquin Light and Power Company. The capacity of the plant is 750 tons per ten hours and the rock is sold at from 20 to 30 cents per ton on the cars of the Yosemite Valley Railroad. Only a few men were at work when the property was visited.

Yosemite Stone Quarry. This property consists of 40 acres of patented land owned by the Ransome-Crummey Company of Oakland and located on the Merced River at Exchequer on the Yosemite Valley Railroad. The rock is a fine grained diorite and the dike is about 500 feet wide between the walls of slate. The equipment consists of an air compressor and 5 machine drills, a blacksmith shop, gravity tram, two 5-ton cars, 5 Gates gyratory crushers, elevating buckets, 10 motors, one 100-ton ore bin, a large crane, office, and superintendent's house. Power is supplied by the San Joaquin Light and Power Company and 20 men are employed at the present time.



Ransome-Crummey rock crusher at Exchequer, on the Merced River and Yosemite Valley railroad, Mariposa County, California.

SLATE.

Cunningham Slate Quarry. Consists of slate land located in Secs. 6, 7, 8, and 17, T. 7 S., R. 17 E., M. D. M., and owned by the Cunningham Corporation of Planada, Merced County. The quarry was leased from Cunningham by D. J. Gonyer for fifteen years. The quarry is developed and a good quality of roofing slate produced. It is not working at present.

Pacific Slate Quarry. Consists of 50 acres of land located in Sec. 6, T. 6 S., R. 16 E., M. D. M., 4 miles from Merced Falls and owned by the Pacific Slate Company of Merced, Merced County. The slate is quarried and cut into slabs for roofing purposes mostly. None is being shipped at present, as there is very little demand.

Roofing slate from quarry of Pacific Slate Company in Sec. 6, T. 6 S., R. 16 E.,

Slate Quarry of Pacific Slate Company of Merced, in Sec. 6, T. 6 S., R. 16 E., M. D. M.

MERCED COUNTY.

By F. L. LOWELL, Field Assistant.

Field work in September, 1914.

Merced is, strictly speaking, an agricultural county. Most of its ,276,800 acres of land is under cultivation and the question of water as long been settled by the introduction of a system of irrigating itches which is augmented by numerous flowing wells.

There is very little mineral in the county and only one gold mining mpany is operating. The mineral indications are found in the Coast ange mountains in the southwestern part of the county adjoining anta Clara County and in the northeastern part adjoining Mariposa ounty.

ASBESTOS.

Asbestos is said to occur near the Mariposa County line in . 7 and 8 S., R. 16 E., M. D. M. No work has been done on it and no formation could be obtained about it.

CLAY.

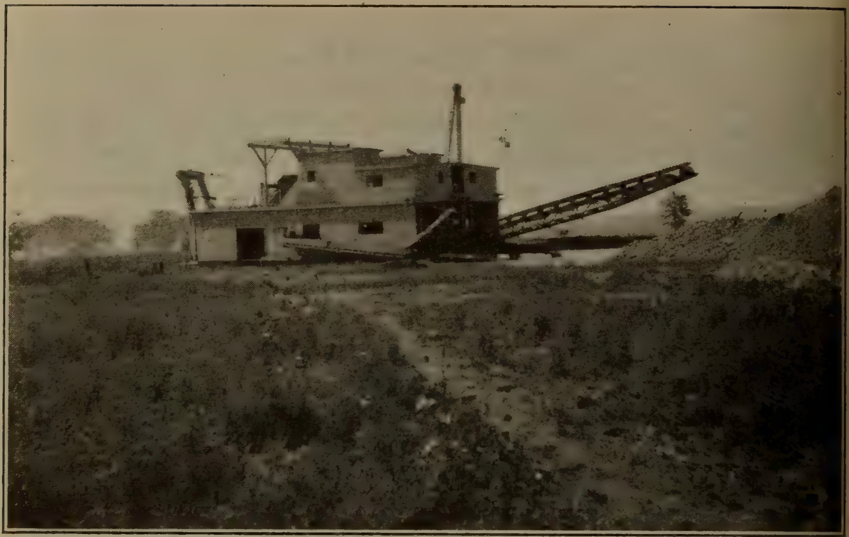
A white clay said to be suitable for the manufacture of pottery when ixed with other clay that gives it the required fatty consistency is und in the region of Merced Falls, on the land owned by M. Goldman, Merced. It is not being worked although many experiments have en made with it to test the quality. Clay also is said to be found in 5 S., R. 14 E.

COPPER.

Copper has been found in the south end of the county but not in fficient quantities to pay commercially.

Jose Copper Claim. This claim is located in Sec. 4, T. 13 S., 9 E., M. D. M., about 35 miles from Hollister, San Benito unty. The ledge proper has not been discovered, but what appears have been a slide from the ore body has been developed by a 500-foot nnel. A small quantity of chalcopyrite running high in gold and ver values was found. The claim has been idle for a number of ars.

Victor Bonanza Group. This group of copper claims is located in cs. 14, 15, 16, 23, 24 and 25, T. 13 S., R. 9 E., and Secs. 30 and , T. 13 S., R. 10 E., M. D. M., 16 miles from Dos Palos. Native pper and chalcopyrite have been found in the croppings. The forma- n is sandstone and porphyry. Practically no development has been ne. (See "Copper Resources of California," Bulletin No. 50.)



Yosemite Gold Dredging and Mining Company's dredge at Snelling, Merced County, California.

GOLD.

The only gold mining that is being done at present is that at Snelling on the Merced River where the Yosemite Gold Dredging and Mining Company operates a dredge on their 400 acres along the river. The gravel is a clean wash and quite free from clay or large boulders. The gravel averages 20 feet to bedrock and a total of 24,200 cubic yards averaged 16½ cents per yard, and working costs 6½ cents per yard. The gold is coarse, clean and easy to save. The electric power is supplied from their own plant on the Merced River which is about 1½ miles from the dredge and costs not over 1¾ cents per kilowatt hour. (See "Gold Dredging in California," Bulletin No. 57.)

MANGANESE.

Briggs Mine. This mine is owned by N. C. Briggs, of Hollister, San Benito County, and is located in Sec. 16, T. 13 S., R. 9 E., M. D. M. The manganese deposit is claimed to show on the surface over a width of 100 to 200 feet. Very little development work has been done. (See "Structural and Industrial Materials of California," Bulletin No. 38, for Manganese, also U. S. G. S. Bulletin No. 427.)

WATER.

As said before, this county is well supplied with water, both from wells which reach water at a comparatively short distance from the surface, and also from the four irrigating systems whose canals traverse the county. Among these four systems is the Crocker and Huffman Land and Water Company, which also supplies the city of Merced with municipal water.

SAN JOAQUIN COUNTY.

By F. L. LOWELL, Field Assistant.

Field work in August, 1914.

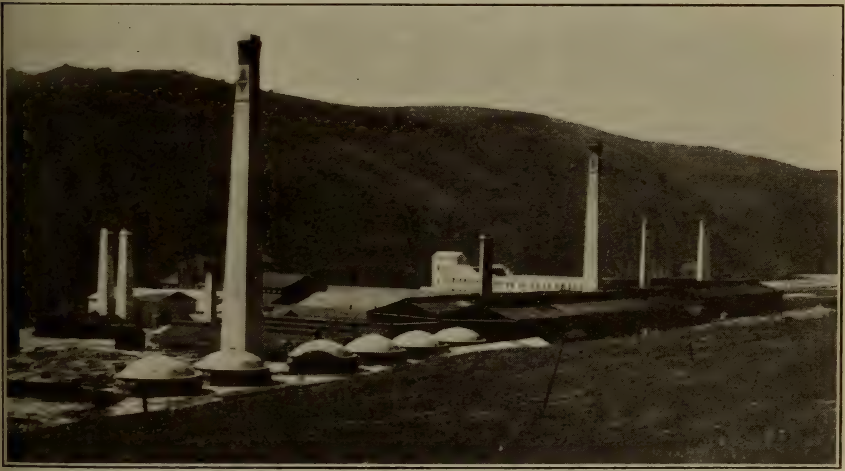
San Joaquin County, of which Stockton is the county seat, has an area of 1370 square miles or approximately 926,720 acres. Of this acreage 763,048 acres are in farm lands. The population of the county was 50,731 in 1910. The county may be classed as agricultural and very little mineral is found in commercial quantities to pay for working.

The principal output under a mineral head is natural gas. There is also some manganese, clay and indications of coal in the Corral Hollow district in the southern end of the county. Water is abundant and is obtained from wells and irrigation ditches. The county is bounded on the north by Sacramento County, on the northeast by Amador and Calaveras counties, on the east and southeast by Stanislaus County, on the southwest by Alameda County and on the west by Contra Costa County.

BUILDING MATERIALS.

Brick and pottery.

Carnegie Brick and Pottery Company. This company, which owns the E. ½ of Sec. 33, and the W. ½ of Sec. 34, T. 3 S., R. 4 E., M. D. M., has a very extensive plant for the manufacture of brick and terra cotta on the Tesla line of the Western Pacific Railroad at Carnegie. The clay came from the Tesla coal mine in Alameda County and was hoisted from the underground workings and conveyed by railroad to the brick plant. The plant includes forty-five brick kilns



Carnegie Brick and Pottery Company's Plant at Carnegie, San Joaquin County, California. Photo by Walter W. Bradley.

Floor construction of a brick kiln at the Carnegie Brick and Pottery Plant, San Joaquin County, California. Photo by Walter W. Bradley.

and the equipment cost in the neighborhood of half a million dollars. It has not been in operation since 1912. The brick and terra cotta plant is in San Joaquin County and the mine and pottery plant are in Alameda County.

San Joaquin Brick Company Plant (red brick). This property consists of sixty acres of clay land on Roberts Island, outside of Stockton, and is a consolidation of the San Joaquin Brick Company plant and the Roberts Island Brick Company plant, with offices at 33 South El Dorado street, Stockton. The clay is dredged from the slough by a Marion steam dredger and allowed to weather in the air before it is used for making the common red brick.

The plant consists of 2 kilns, 2 brick machines, 2 brick cutters, one 40 h.p. motor, one steam shovel on a barge, dry sheds and other buildings. Forty men are employed and the plant has a capacity of 40,000 brick per day with one unit and could produce 80,000 with another unit operating.

Stockton Fire and Enamel Brick Company Plant. The plant is located on the outskirts of the city of Stockton near the glass works and Jackson baths, and consists of 5 brick kilns, 2 brick pressing machines,

oberts Island Brick Plant, owned by the San Joaquin Brick Company of Stockton, San Joaquin County, California.

cutting machines, pugmill, dry pan, oil tanks, 2 boilers and a steam
gine. The brick machinery is run by four motors, the power being
pplied by the Western States Gas and Electric Company. Twenty-
ve men are employed. This company manufactures fire-brick, face
rick, hand moulded material, and linings. The clay comes from
arnegie, Ione, Valley Springs and Lincoln. The capacity of the plant

tockton Fire and Enamel Brick Company's plant at Stockton, San Joaquin County, California.

is 50,000 brick per day, besides hand moulded material. Red brick is not manufactured. The plant has been working two years and is on a spur track of the Southern Pacific Railroad.

NATURAL GAS.

Natural gas has been a very important factor in the fuel question of the manufacturing industries of San Joaquin County and, together with the cheap water transportation to San Francisco Bay, gives the city of Stockton an enviable advantage over other valley cities. Most of the natural gas wells of the county that have produced or are producing at the present time are located in the vicinity of Stockton. It has been stated before that the flow of water with the flow of gas is merely "incidental and not the necessary concomitant of gas." I did not find this to be altogether correct as in nearly all cases where the flow of water has diminished, the gas also has diminished, and at the present time some of the wells are being "forced;" in other words, the gas is forced back into the well to create a greater flow of water, as a greater flow invariably carries an increased flow of gas. The gas wells at the state asylum are kept alive and producing by this method. The wells at this institution are becoming filled up with sand and the supply of gas is now hardly adequate for their use. The officials consider that a natural gas well is a paying investment and would like to have a new well bored for their increasing demand. The first gas well in the county was bored, not for gas, in fact it was not known that gas lay in the strata below, but was drilled in order to get a flow of artesian water that would flow into one of the sloughs, thereby clearing the slough of stagnant water and removing objectionable odors. When the water was tapped gas also began to flow and the casing was capped and later a gasometer was put on the top and the gas was sold to a few customers This company put down one other well and has a franchise from the city of Stockton for its pipe mains and supplies about 250 customers but are not extending the business. This company, called the Centra Natural Gas Company, and the Western States Gas and Electric Company, are the only two companies that are marketing the gas. There are several other gas wells owned by individuals, the gas from which is used locally for fuel and light.

Central Natural Gas Company. This company owns two gas well located in the town limits of Stockton. The first well, or No. 1, wa put down about eighteen years ago at American street and Miner avenue and went to a depth of about 1400 feet. Began drilling in 189 and finished in 1899. The original flow was 32,000 cu. ft. but now flow 5000 cu. ft. per day. No. 2 well, which is located on Mr. Hoyle Greenwood's property at 229 North San Joaquin street, was drilled with rig similar to the Keystone drill, to a total depth of 2838 feet abou seven years ago. The well was started with a 16-inch casing and this was reduced to 14, 12, 10 and finally to 6-inch casing at the bottom. The original flow was 100,000 cu. ft. per day.

Analysis of the Gas.

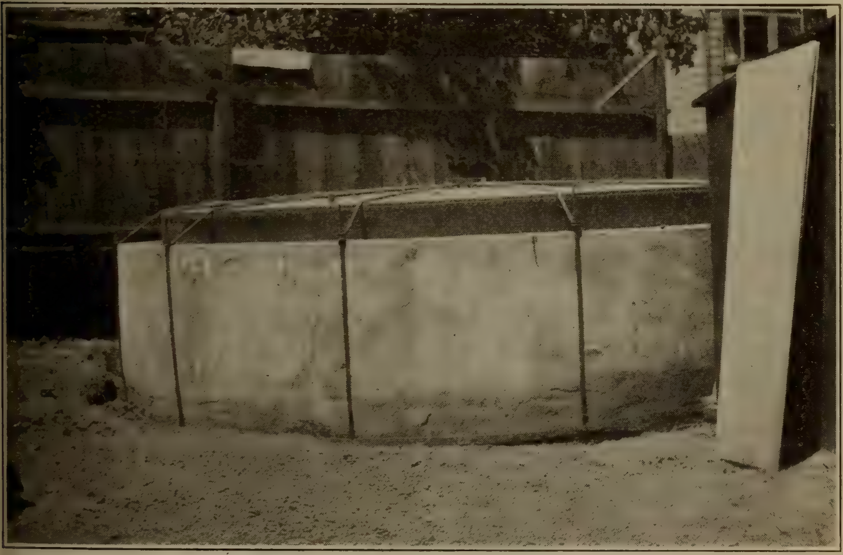
	Per cent by volume	Second analysis
Heavy hydrocarbon CNH_2N	.0	.0
Marsh gas CH_4	73.2	76.4
Hydrogen H_2	.0	.0
Carbonic oxide CO	0.9	0.1
Carbonic acid gas CO_2	0.1	0.4
Oxygen O_2	0.3	0.3
Residual nitrogen N_2	25.5	22.8
Specific gravity (Air-1)	0.663	
Gross B. T. U.	788	819
Per cent combustible	74.1	
Noncombustible	25.9	

Sulphur 60 grams per 100,000 feet.

Heats of combustion used for B. T. U. calculation: CNH_2N 2,000, CO 343, CH_4 1073, H_2 344,

Temperature of the water at a depth of 2,838 feet was 104°. Temperature at the present time is 95°.

The flow of gas from the No. 2 well at the present time is from 30,000 to 40,000 cu. ft. per 24 hours, calculated from the amount sold to customers, there being no meter connected. No log has been kept of the well, but Mr. Greenwood says that strata of sand and gravel were encountered from the surface to a depth of 350 feet, also blue clay and lava, and from that point down cobblestones were encountered. Gas was tapped at the 1200-foot point and was accompanied with water. Water always accompanies the gas.



Central Natural Gas Company's well at 229 North San Joaquin street, Stockton, San Joaquin County, California.

The No. 1 well has not been producing gas for some time and needs to be cleaned out and new casing put in. The company has 250 customers and a franchise for its pipes in the city but is not extending its scope of operations.

The water flowing from the wells is not used for any purpose but flows into the sloughs, thereby keeping them free from stagnation. N. E. Carpenter is president of the company, 29 North Grant street, and Hoyle Greenwood is secretary, 229 North San Joaquin street.

Clark Gas Well. This well is located at Lincoln and South streets, in the city limits of Stockton, and is owned by Mrs. Percival. It was bored twenty-five years ago and had a gas flow for some years but has now ceased flowing.

Court House Gas Well. Located in the yard of the jail in Stockton and was started in 1890 and bored to a depth of 1900 feet. The casing at the top was 12 inches in diameter. It had a flow of 30,000 cubic feet per day, but is now dead.

Cowan Gas Well. Located on West Lane road, six miles from Stockton, and owned by T. C. Cowan. The well was drilled twenty-three years ago to a depth of 1160 feet. Enough gas flowed to supply the domestic demand for lighting and fuel. The water flowing from the well is not used as it is injurious to vegetable life. This well is still producing.

Crown Mills Gas Well. Located at the Crown flour mill and was drilled in 1887 to a depth of 1330 feet. It has a 9-inch casing and formerly flowed at the rate of 7000 cu. ft., but is now dead. The gas was used for lighting the mill and also for fuel in the boiler house.

Lathrop Gas Well. Located in the town of Lathrop. It was drilled in 1888 to a depth of 1420 feet and had 8-inch casing from top to bottom. The flow of water rose two feet above the collar of the casing and was estimated at 300,000 gallons per 24 hours. The well also produced 3000 cu. ft. of gas per day, but has been dead for a long period.

Roberts Island Gas Well. Located on the Kidd ranch on Roberts Island. It was drilled about twenty-five years ago and had a small flow of gas, but is dead now.

Salmon Gas Well. Located on Atlanta road just below French Camp, $\frac{1}{4}$ of a mile from Sharp Lane. It was bored about thirty years ago and had a small flow of gas, but is dead now.

St. Agnes College Wells. Located in the grounds of St. Agnes Convent in Stockton. The two wells were drilled to a depth of 960 and 1720 feet respectively and had 10-inch casing. They produced 25,000 cu. ft. of gas per day, which was used for fuel and illuminating purposes in the convent. The wells are filled with sand and are dead now.

Stockton State Hospital Wells, Nos. 1 and 2. Located at the hospital for the insane at Stockton. Well No. 1 was drilled about twenty years ago to a depth of 1600 feet with 8-inch casing. It has been dry for three years. The temperature of the water was 84° and highly charged with magnesia and iron.

Well No. 2 was drilled at about the same time as well No. 1, with 16-inch casing at the top. This well is being "forced" at the present time to increase the flow of gas. The water is conveyed to a swimming pool for the patients' use. The gas is used for cooking purposes about the asylum, but the supply is not equal to the demand as the flow is not over 900 cu. ft. per day. The well is badly filled with sand.

Western States Gas and Electric Company Gas Wells. The Western States Gas and Electric Company is an incorporated company with its home office in San Francisco and doing business in Stockton with its local office at 44 North Sutter street. H. M. Byllesby of Chicago is president; Samuel Kahn of Stockton, vice president and general manager, and Allen L. Chickering of San Francisco, secretary. The company owns an extensive gas manufacturing plant and electric plant as well as sixteen natural gas wells, five of which have ceased to flow. The natural gas is all piped to the central plant and mixed with the manufactured gas and then goes to the consumer. The company owns most of the natural gas wells now producing. The water flowing from their wells is not utilized except in the case of the Jackson No. 2 well, which supplies water for the swimming tank of the Jackson baths which adjoin.

Natural Gas Wells owned by Western States Gas and Electric Company of Stockton, California:

Well No. 1.

Located at Lafayette and Lincoln streets.
Began drilling in 1892 and finished in 1896.
Total depth of 1702 feet.
Twelve and 8-inch casing.
Not flowing at present.
Original flow was 15,400 cu. ft. per day.
Water flow was 200 gallons per minute.
Well is now dead.

Well No. 2.

Formerly owned by the Stockton Natural Gas Company.
Located at Lafayette and Lincoln streets.
Began drilling in 1886 and finished in 1888.
Twelve-inch and 7-inch casing.
Original flow was 87,000 cu. ft. per day.
Water flow was 1500 gallons per minute.
Well is now dead.

Well No. 3.

Formerly owned by the Stockton Natural Gas Company.

Located at Lafayette and Lincoln streets.

Began drilling in 1888 and finished in 1890.

Total depth of 1890 feet.

Twelve-inch and 6-inch casing.

Original flow was 40,000 cu. ft. per day.

Flowing now 12,000 cu. ft. per day.

Temperature of water is 86°.

CH_4	67.1%
CO	0.6%
CO_2	0.2%
O	0.5%
N	31.6%

Well No. 4.

Formerly owned by the Northern Natural Gas Company.

Located at Grant and Fremont streets.

Began drilling in 1892 and finished in 1894.

Total depth of 1720 feet.

Twelve and 6-inch casing.

Original flow was 20,000 cu. ft. per day.

Flows now at rate of 5000 cu. ft. per day.

Original flow of water was 1800 gallons per minute, but much less now.

Temperature of water is 83° F.

CH_4	57.9%
CO	0.6%
CO_2	0.2%
O	0.8%
N	40.5%

Well No. 5.

Located at North and Hunter streets.

Began drilling in 1895 and finished in 1896.

Total depth of 2071 feet.

Twelve and 6-inch casing.

Original flow was 43,300 cu. ft.

Flow is now 30,000 cu. ft. per day.

Flow of water is 300 gallons per minute.

Temperature of water is 86° F.

CH_4	64.5%
CO	0.7%
CO_2	0.4%
O	0.6%
N	33.8%

Well No. 6.

Located at Anderson and Pilgrim streets.
Started in 1895 and finished in 1896.
Total depth of 1810 feet.
Twelve-inch casing at the top and 7-inch at bottom.
Original flow was 28,899 cu. ft. per day.
Flow now 16,000 cu. ft. per day.
Water flow 800 gallons per minute.
Temperature of water is 86° F.

CH_4	67.2%
CO	0.3%
CO_2	0.4%
O	0.7%
N	31.4%

Well No. 7.

Located at Miner avenue and Harrison street.
Started in 1898 and finished in 1900.
Total depth of 2230 feet.
Twelve, 10½, 9, and 7½-inch casing.
Original flow was 72,000 cu. ft. per day.
Flow now is 35,000 cu. ft. per day.
Water flow was 1800 gallons per minute.
Water flow now is 300 gallons per minute.
Temperature of the water is 93° F.

CH_4	66.0%
CO	0.9%
CO_2	0.2%
O	0.6%
N	32.3%

Well No. 8.

Located at El Dorado, between Channel and Miner streets.
Started in 1904 and finished in 1912.
Total depth of 3178 feet.
Sixteen, 14½, 13, 12, 9, 6½-inch casing.
Formerly flowed 60,000 cu. ft. per day.
Now flows 39,000 cu. ft. per day.
Water flow about 504,000 gallons per day.
Temperature of water, 94° F.
Well cost about $75,000.

CH_4	73.5%
CO	0.6%
O	0.2%
N	25.3%

(See attached sheet of log, page 194.)

Well No. 9.

Located at Miner avenue and East street.

Started in 1902 and finished in 1908.

Total depth of 2603 feet.

Sixteen, 14½, 13 and 12-inch casing.

Formerly flowed 120,000 cu. ft. per day.

Now flows 85,000 cu. ft. per day.

Water flow is 720,000 gallons per day.

Temperature of water is 96° F.

CH_4	70.8%
CO	0.5%
CO_2	0.1%
O	0.3%
N	28.3%

(See attached sheet of log, page 195.)

Well No. 10.

Formerly belonged to Northern Natural Gas Company.

Located at Acacia, between San Joaquin and Hunter streets.

No record of time the well was drilled.

Total depth, 2006 feet.

Twelve, 10½, 8½, 7 and 6-inch casing.

No record of original flow.

One of the oldest wells in this district.

Well is now dead.

CH_4	66.0%
CO	1.4%
CO_2	0.4%
O	0.9%
N	31.3%

Citizens No. 1.

Formerly owned by the Citizens Natural Gas Company.

Located on Commerce street, between Rose and Vine streets.

No records of the well to be obtained.

Water flowed at rate of 800 gallons per minute.

Well is now dead.

Citizens No. 2.

Formerly owned by the Citizens Natural Gas Company.

Located at North and Addison streets.

Total depth is 1850 feet.

Twelve, 10 and 8-inch casing.

Present flow is 39,000 feet per day.

Temperature of the water is 86° F.

CH_4	68.1%
CO	0.4%
CO_2	0.3%
O	0.7%
N	30.5%

Jackson No. 1.

Originally owned by John Jackson.

Located at San Joaquin and Tenth streets.

Started in 1894 and finished in 1896.

Total depth of 1702 feet.

Twelve and 6-inch casing.

Originally flowed 30,000 cu. ft. per day.

Well is now dead.

Water flow 600 gallons per minute.

CH_4	59.5%
CO	0.6%
CO_2	0.4%
O	0.4%
N	39.1%

(For both Jackson No. 1 and No. 2.)

Jackson No. 2.

Formerly belonged to John Jackson.

Located at San Joaquin and Tenth streets.

Started in 1895 and finished in 1898.

Total depth of 1600 feet.

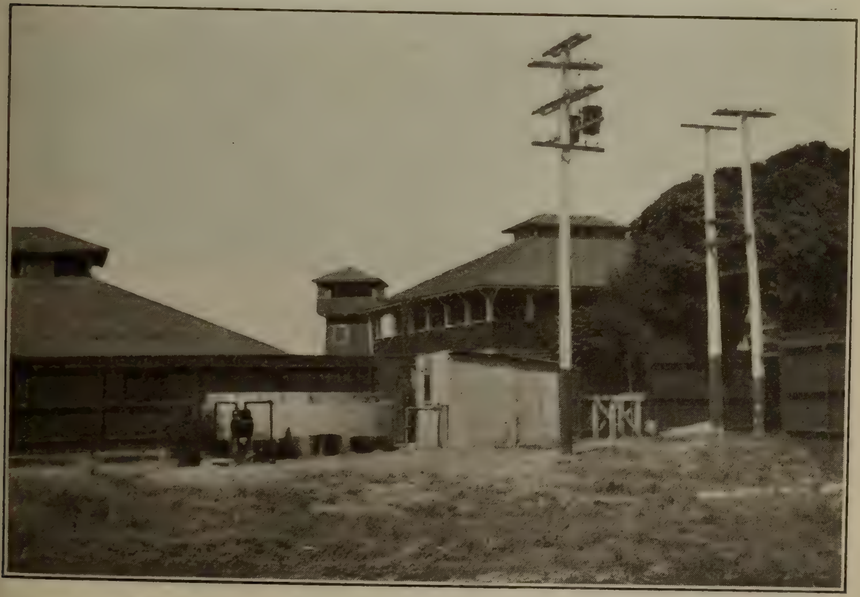
Twelve and 7-inch casing.

Flowing originally 35,000 cu. ft. per day.

Now flows 6,000 cu. ft. per day.

Water flow originally 600 gallons per minute.

Temperature of water 84° F.



Jackson No. 2 well at Jackson Baths, belonging to the Western States Gas and Electric Company of Stockton, San Joaquin County, California.

Glass Works Well No. 1.

Formerly belonged to Stockton Window Glass Company.

Located at San Joaquin and Fourteenth streets.

Well drilled in about 1904.

Total depth 2000 feet.

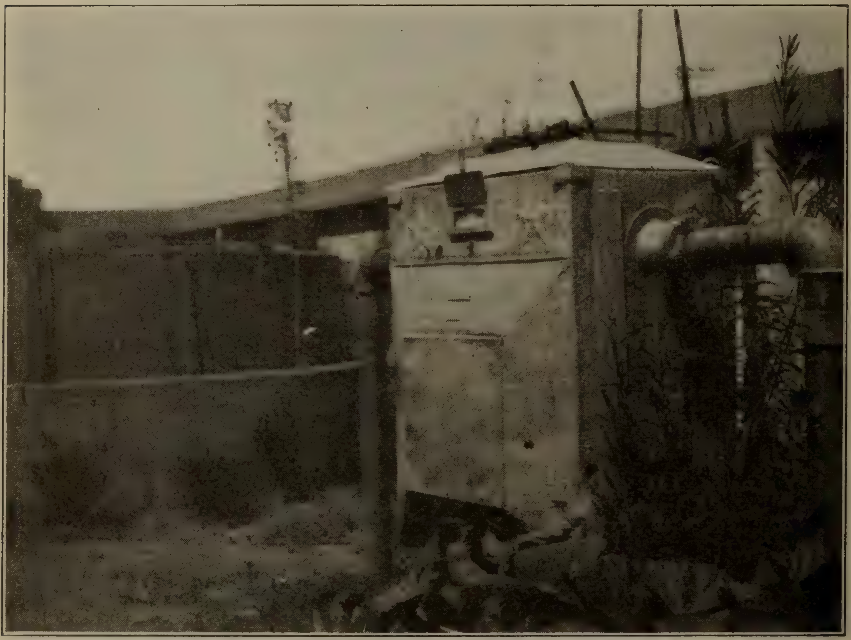
Twelve and 6-inch casing.

Flows 16,000 cu. ft. per day.

Water flow about 250 gallons per minute.

Temperature of water 92° F.

CH_4	69.8%
CO	0.7%
CO_2	0.4%
O	0.3%
N	28.8%



Gasometer and meter of a natural gas well in Stockton, belonging to the Western States Gas and Electric Company.

Glass Works Well No. 2.

Formerly owned by the Stockton Window Glass Company.

Located at San Joaquin and Fourteenth streets.

No record of the date when the well was drilled. Think it was drilled about 1904.

Total depth 2100 feet.

Twelve and 6-inch casing.

Flows 7000 cu. ft. per day.

Water flow about 150 gallons per minute.

Temperature of water is 90° F.

Log of Well No. 7.

Formation.	Feet	to feet.
Adobe	0	3
Yellow clay	3	24
Blue clay	24	45
Sand and small stone	45	51
Blue clay	51	154
Cemented blue clay	154	164
Coarse sand	164	184
Clay	184	190
Sand, gravel and stone	190	238
Blue clay	238	242
Loose sand	242	340
Blue clay	340	354
Cement sand	354	651
Blue clay	651	655
Loose sand	655	726
Clay	726	731
Sand	731	768
Clay	768	786
Sand and cemented clay	786	840
Tough blue clay	840	897
Hard clay	897	915
Tough clay	915	928
Hard clay	928	956
Coarse clay	956	1,076
Clay	1,076	1,083
Sand	1,083	1,115
Clay	1,115	1,122
Loose sand	1,122	1,174
Clay	1,174	1,212
Coarse sand and stone	1,212	1,274
Small stone	1,274	1,290
Hard clay	1,290	1,346
Packed sand	1,346	1,354
Hard clay	1,354	1,382
Sand and pebbles	1,382	1,386
Hard clay	1,386	1,436
Coarse sand	1,436	1,439
Tough clay	1,439	1,452
Hard clay	1,452	1,517
Tough clay	1,517	1,532
Hard clay	1,532	1,560
Sand	1,560	1,563
Hard clay	1,563	1,594
Tough clay	1,594	1,598
Hard clay	1,598	1,674
Sand	1,674	1,689
Clay	1,689	1,723
Loose sand	1,723	1,733
Clay	1,733	1,777
Loose sand	1,777	1,795
Clay	1,795	1,798
Sand	1,798	1,804
Clay	1,804	1,811
Loose sand	1,811	1,813
Clay	1,813	1,868
Loose sand	1,868	1,886
Clay	1,886	1,961
Sand	1,961	1,969
Clay	1,969	2,053
Loose sand	2,053	2,063
Clay	2,063	2,068
Loose sand	2,068	2,093
Clay	2,093	2,193
Sand	2,193	2,194
Hard cemented clay	2,194	2,206
Loose sand	2,206	2,213
Hard cemented clay	2,213	2,222
Loose sand	2,222	2,230

Log of Well No. 8.

Formation.	Feet	to feet.
Clay	0	25
Sand	25	29
Clay	29	65
Sand	65	68
Clay	68	196
Gravel	196	202
Clay	202	220
Gravel	220	232
Clay	232	334
Sand	334	345
Clay	345	384
Sand	384	390
Clay	390	440
Sand	440	448
Clay	448	680
Sand	680	700
Clay	700	710
Sand	710	728
Clay	728	760
Sand	760	768
Clay	768	818
Sand	818	826
Clay	826	975
Sand	975	982
Clay	982	1,019
Sand	1,019	1,030
Clay	1,030	1,243
Gravel	1,243	1,253
Clay	1,253	1,460
Sand	1,460	1,468
Clay	1,468	1,616
Sand	1,616	1,619
Clay	1,619	1,725
Sand	1,725	1,738
Clay	1,738	1,960
Sand	1,960	1,970
Red clay	1,970	1,980
Yellow clay	1,980	2,000
Blue and white clay	2,000	2,120
Sand	2,120	2,132
Sticky blue clay	2,132	2,600
Sand	2,600	2,607
Gravel	2,607	2,648
Blue clay	2,648	2,700
Red clay	2,700	2,790
Black clay	2,790	2,800
Sand	2,800	2,845
Gravel	2,845	2,880
Sand	2,880	2,900
Gravel	2,900	2,907
Brown clay	2,907	3,060
Black sand	3,060	3,175
Blue clay	3,175	3,178

Log of Well No. 9.

Formation.	Feet	to feet.
Adobe	0	2
Yellow clay	2	14
Sand	14	17
Clay	17	82
Blue clay	82	174
Yellow clay	174	190
Sand	190	220
Blue clay	220	232
Black sand	232	240
Blue clay	240	445
Sand	445	450
Blue clay	450	485
Coarse white sand	485	492
Blue clay	492	584
Sand	584	588
Blue clay	588	605
Sand	605	614
Blue clay	614	698
Sand	698	705
Blue clay	705	1,056
Coarse sand	1,056	1,061
Blue clay	1,061	1,190
Coarse sand	1,190	1,205
Hard blue clay	1,205	1,338
Cemented sand and stone	1,338	1,343
Clay	1,343	1,475
Cemented sand and stone	1,475	1,483
Clay	1,483	1,608
Loose sand and stone	1,608	1,620
Clay	1,620	1,850
Sand and stone	1,850	1,853
Sand and clay in thin layers	1,853	2,018
Red, white and blue clay	2,018	2,025
Sand	2,025	2,032
Clay	2,032	2,038
Sand	2,038	2,044
Clay	2,044	2,070
Sand	2,070	2,176
Clay	2,176	2,186
Sand	2,186	2,196
Clay and sand in thin layers	2,196	2,500
Clay	2,500	2,600
Sand	2,600	2,603

The first flow of gas was struck at 2025 feet.

The next flow at 2044 feet, and the third flow at 2176 feet.

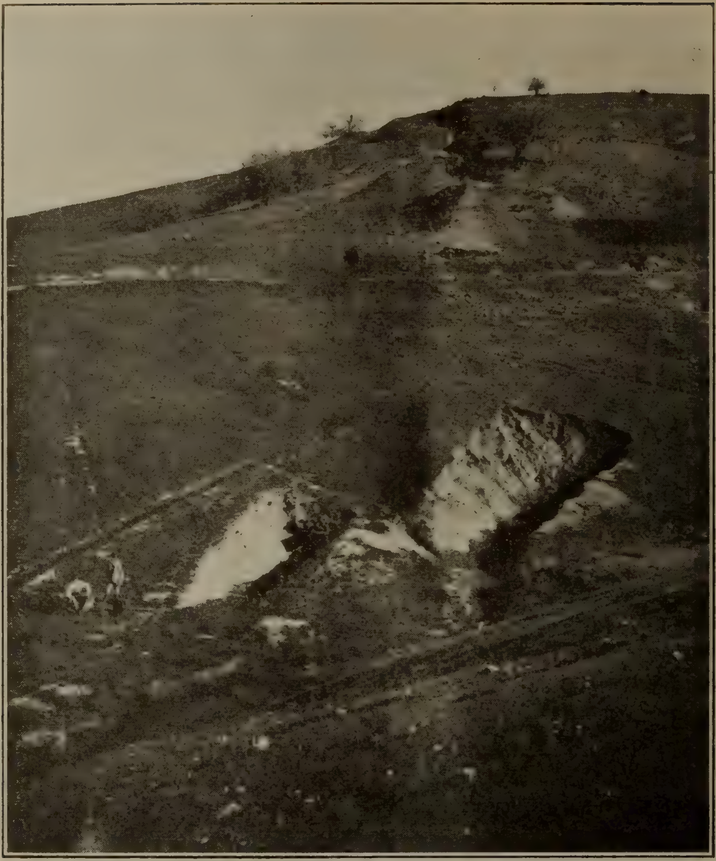
The best flow of gas was struck at 2600 feet.

This well is the best that the company owns.

MANGANESE.

The characteristic occurrences of manganese in California are in the form of black oxide associated as layers and pockets with the jasper lenses of the Franciscan formation of probable Jurassic age. Manganite seems to be the most prevalent variety of manganese encountered in the Livermore range of hills.

Manganese Prospect. This property consists of the SE. ¼ of Sec. 2, T. 4 S., R. 4 E., and about 1½ miles south by road of the branch line of the Western Pacific Railroad which runs to the Tesla coal mine. The land was formerly owned by J. Caire, who sold it to J. Treadwell and it is now in the hands of Frank J. Symmes, trustee,



Manganese prospect in Sec. 11, T. 4 S., R. 4 E., M. D. M., owned by the Winship Estate. Photo by Walter W. Bradley.

491 California street, San Francisco. According to the Tenth Mineralogist Report, about 2000 feet of tunneling has been done and some stoping, which have caved. No work has been done on the property for eight years. The manganese is in the jasper formation and the lenses vary from one to ten feet in width. There are many manganese coatings on the cherts in these hills but they are not of sufficient purity to be of commercial value.

Manganese Prospect. In Sec. 11, T. 4 S., R. 4 E., M. D. M., owned by the Winship Estate, 354 Pine street, San Francisco, and leased by D. P. and F. M. Doak, of the Rialto Building, San Francisco. This prospect has been working the last few months and has been developing manganese ore.

(See U. S. Geological Survey, Bulletin No. 427, for further reference to Manganese of the State.)

WATER.

The county is well supplied with subterranean water and water from irrigation ditches. Many of the farms of the county rely on their wells for irrigating. Care must be exercised in selecting a water well location that it is not in close proximity to a gas well. Cases have been known where the deeper gas well has contaminated the water well by the gas penetrating the water strata and flowing with the water to the water well. This is especially likely when the casing of the gas well has been worn away thus giving free access to the water strata.

The principal irrigation district of the county takes its water from the Stanislaus River at Knights Ferry in Stanislaus County. This water is owned jointly by the South San Joaquin irrigation district and the Oakdale irrigation district of Stanislaus County, and irrigates 137,000 acres of farm land. There are eight miles of main canal, lateral canals and a storage reservoir with a capacity of 184,000 acre feet.

Woodbridge Canal and Irrigation Company. This company takes water from the Mokelumne River at the town of Woodbridge, and also water from the Calaveras River at the town of Bellota. This company, with its system of canals, irrigates the greater portion of the county north and east of Stockton.

There is another ditch that brings water from Mokelumne River in Calaveras County. This ditch enters San Joaquin County at its northeast corner and supplies water for that section. It is seen that the irrigation problem is thoroughly solved and insures good crops at all times.

Stockton water district.

The city of Stockton is supplied with water from wells which are owned by the Pacific Gas and Electric Company. The water bearing strata are encountered between the depths of 550 feet and 557 feet. The logs of the wells are similar to those of the gas wells. The total solids held in solution amount to 20.85 grains per gallon and are chiefly calcium and magnesium carbonates, a little silica and some alumina. The free ammonia present amounts to 0.062 parts per million parts of water. The albuminoid ammonia amounts to 0.126 parts per million.

PACIFIC GAS AND ELECTRIC COMPANY.

Stockton Water District. Wells at Pumping Station No. 1.

Number	Diameter of casing	Depth	Date of construction	Date last time cleaned	Depth last time cleaned	Location	Cost	Abandoned
1	8-inch at top, 6-inch below 800 feet	1,100	1882	Feb., 1912	1,000	Northeast corner old tract	$2,500 00	
2	6-inch at top, 5-inch below 650 feet	960	1884			Northwest corner of lot, brick sump	2,000 00	
3	8-inch throughout	1,040	1885		955	In street south of pit	2,500 00	1912
4	10-inch throughout	560	1891	Jan. 30, 1914	569½		2,000 00	
5	8-inch throughout	218	1895				2,000 00	
6	8-inch throughout	218	1895				2,500 00	
7	8-inch throughout	300	1895				2,500 00	
8	8-inch throughout	577	1895				2,500 00	
9	12-inch throughout	770	1900	Jan. 16, 1914	770		2,600 00	
10	20-inch throughout	223	1902	Jan. 20, 1914	223		1,612 00	
11	12-inch throughout	950	1906	Jan. 22, 1914	950		3,200 00	
12	14-inch at top, 12-inch below 268 feet	1,002	1907	Jan. 23, 1914	1,002		3,400 00	
13	14-inch at top, 12-inch below 250 feet	1,050	1908–9	Jan. 26, 1914	1,043		3,700 00	
14	20-inch throughout	223	1910	Jan. 15, 1914	223		1,200 00	
15	14-inch 225 feet, 12-inch 605 feet, 10-inch 223 feet	1,053	1911	Feb. 15, 1913	1,053		3,491 53	
16	16-inch 239 feet, 14-inch 598½ feet, 12-inch 214½ feet	1,502	1912	Mar., 1913	1,052		4,283 76	
17	17-inch throughout	201	1912				4,514 81	
18	14-inch top, 12-inch below 861 feet	1,124	1913				4,514 81	
19	16-inch 250 feet, 14-inch 236 feet 12-inch 159 feet	674	1913–4					

There used to be sixty 2-inch wells at Pump Station No. 1, all abandoned between 1906 and 1910.

Wells at Pump Station No. 2.

Number	Diameter of casing	Depth	Date of construction	Date last time cleaned	Depth last time cleaned	Location	Cost	Abandoned
1	12-inch at top, 10-inch below 632 feet	667	1903	Jan. 9, 1914	667			
2	12-inch at top, 10-inch below 594 feet	807	1904	Jan. 10, 1914	798			
3	14-inch at top, 12-inch below 260 feet	975	1909	Jan. 5, 1914	962			
4	14-inch at top, 12-inch below 250 feet, 10-inch below 800 feet	875	1909	Jan. 12, 1914	872			
5	12-inch throughout	671	1912	Jan. 10, 1914	370	Bottom 300 feet caved		

Yearly consumption of water by the city of Stockton.

Year	Gallons consumed	Year	Gallons consumed
1893	678,910,112	1903	796,401,859
1894	515,675,810	1904	708,797,128
1895	704.028.212	1905	837,814,614
1896	679.037.239	1906	942,683,776
1897	781,830,337	1907	943,575,767
1898	936.958.406	1908	1,057,675,182
1899	981,052,765	1909	1,057,552,130
1900	646,591,937	1910	1,166,756,023
1901	648,469,829	1911	1,205,951,517
1902	774.989.079		

Costs—$1.50 per foot for drilling 12-inch to 16-inch well to 1000 feet.

WINDOW GLASS.

Stockton Window Glass Company Plant. This plant, which is located in the suburbs of the city of Stockton, is owned by the Western States Gas and Electric Company of Stockton and was built in 1901. It was operated for a time but closed down in 1908. It is on a spur track of the Southern Pacific Railroad and has a complete equipment for the manufacture of common window glass, chipped glass and fancy glass for signs, doors, etc. Oil is used as fuel. The plant was formerly owned by the California Trust Company and after being in the law courts for some time, was bought by the Western States Gas and Electric Company in 1911. Capital was not available to put it on a good financial footing. The sand is brought from Monterey County and is a beach sand. The lime comes from San Francisco, soda from Pennsylvania Chemical Company, and salt cake from Point Richmond.

Stockton Window Glass Plant at Stockton, San Joaquin County, California, owned by the Western States Gas and Electric Company.

STANISLAUS COUNTY.

By F. L. LOWELL, Field Assistant.

Field work in September, 1914.

Stanislaus County, which comprises 951,000 acres of land, extends from the eastern foothills of the Coast Range on the southwest and runs across the San Joaquin Valley in a northeasterly direction to the western foothills of the Sierra Nevada mountains. Most of the land is under cultivation and very little mineral is found within its boundary. In the southwestern part of the county, beginning at Mt. Boardman in the Coast Range, some quicksilver, manganese and magnesite are found, and a little further east silica, sand and clays are found. The central portion of the county is devoted exclusively to farming, fruit raising, and stock raising, and no mineral is encountered until the northeastern part of the county is reached in the Sierra Nevada foothills. Gravel from the Stanislaus River at Oakdale is utilized for road purposes, and at Knights Ferry, on the Stanislaus River, some ochre is shipped each year. The principal mining operations in the county are at La Grange, where gold dredging is carried on with success. There are five irrigation projects in the county which give an ample supply of water for all the land not served by wells.

BUILDING MATERIALS.

Red Brick.

Craycroft Brick Yard. Owned by the Modesto Repressed Brick Company and located on a 20-acre piece of land on the outskirts of the city of Modesto. The plant was established in 1907 and consists of two boilers, brick trays, 700-barrel oil tank and residence. The clay is obtained on the ground and is worked up by horse power and molded by hand. The brick is sold from $8 to $10 per thousand and is used mostly in local building operations.

Gravel.

Brichetto Bros. Gravel Pit. This gravel pit is located in the bed of the Stanislaus River near Oakdale, in Secs. 10 and 11, T. 2 S., R. 10 E., M. D. M. The gravel ranges in size from very fine to coarse boulders and is used for road work.

Dixon Gravel Pit. Owned by Mrs. Dixon, of Oakdale, and located in the bed of the Stanislaus River. The gravel is used on the roads and for concrete work.

Dorsey Bros. Gravel Pit. Owned by E. W. and E. S. Dorsey, of Oakdale, and located in Secs. 10 and 11, T. 2 S., R. 10 E., M. D. M., near Oakdale on the Stanislaus River. There is a road to the gravel pit, and the material is sold for road work.

Craycroft brick yard at Modesto, owned by the Modesto Repressed Brick Company, of Modesto.

Gold dredge belonging to the La Grange Gold Dredging Company, at La Grange, on the Tuolumne River.

Wheeler Gravel Pit. Owned by W. F. Wheeler, of Oakdale, and located in Secs. 10 and 11, T. 2 S., R. 10 E., M. D. M., on the Calaveras River. The land is patented. The gravel is used on the roads and for concrete work. The gravel is sold at 25 cents per wagon load at the pit.

Clay.

A good clay suitable for brick is located in Secs. 20 and 21, T. 5 S., R. 7 E., M. D. M., and owned by J. J. Cummins and Thomas H. Wolf, of San Francisco. The clay is located on a 320-acre piece of patented land, about 3½ miles northeast of Patterson on the Southern Pacific Railroad. The clay contains about 60% silica, 24% alumina, 3% iron, and a little magnesia. It is not being used at present.

GOLD.

There are no gold mines in the county that are being operated at the present time. There is a gold dredge owned by the La Grange Gold Dredging Company that is operating on the Tuolumne River near La Grange.

La Grange Gold Dredging Company. Owns one dredge on the Tuolumne River, having 7 cubic feet close connected buckets, shaking screens, Holmes gold-saving tables, belt tailing conveyor and digs 32 feet below water level. It works on spuds. The company owns 200 acres of dredging ground that averages 35 feet deep. The gravel is medium coarse and the bedrock is soft. The ground was prospected by drills. (See State Mining Bureau Bulletin No. 67, ''Gold Dredging in California.'')

Alto Gold Mine. Owned by the California-Calaveras Mining Company, of 356 Pine street, San Francisco, and located in the eastern half of the Calaveras Grant in the Knights Ferry district. The Calaveras Grant consists of 7200 acres of land and is located partly in Calaveras County and partly in Stanislaus County. This mine had a vertical shaft 400 feet deep, one crosscut 400 feet long, another 200 feet long and a glory hole 600 feet long and 400 feet wide. There formerly was a 40-stamp mill and other equipment, but this has fallen to decay. This property has been in litigation since 1908 and information was very hard to obtain as the mine has not been working for some time.

MAGNESIA.

About 440 acres of land in T. 6 S., R. 6 E., have recently been taken up and about 50 acres of this 440 are located as magnesia land. Three claims are located on El Puerto Creek, about 15 miles from Patterson on the Southern Pacific Railroad.

According to analysis the ores are reported to contain 42.88% magnesia and 0.223% CaO. The ore occurs as stringers in serpentine formation. This ore has been recarbonized by exposure to the atmosphere and will require a slight calcining before use. It is soluble in hydrochloric acid and the resulting magnesium chloride is serviceable in making tile and fire brick. The property is owned by Howard A. Broughton and associates, 520 Rialto Building, San Francisco.

MANGANESE.

Manganese is now one of the most important minerals in this county that is attracting attention at the present time. It is to be found in the southwestern part of the county, in the eastern part of the Coast Range of mountains between Santa Clara County and Stanislaus County. The development work so far has not been very extensive as manganese from California has not been in very great demand until recently.

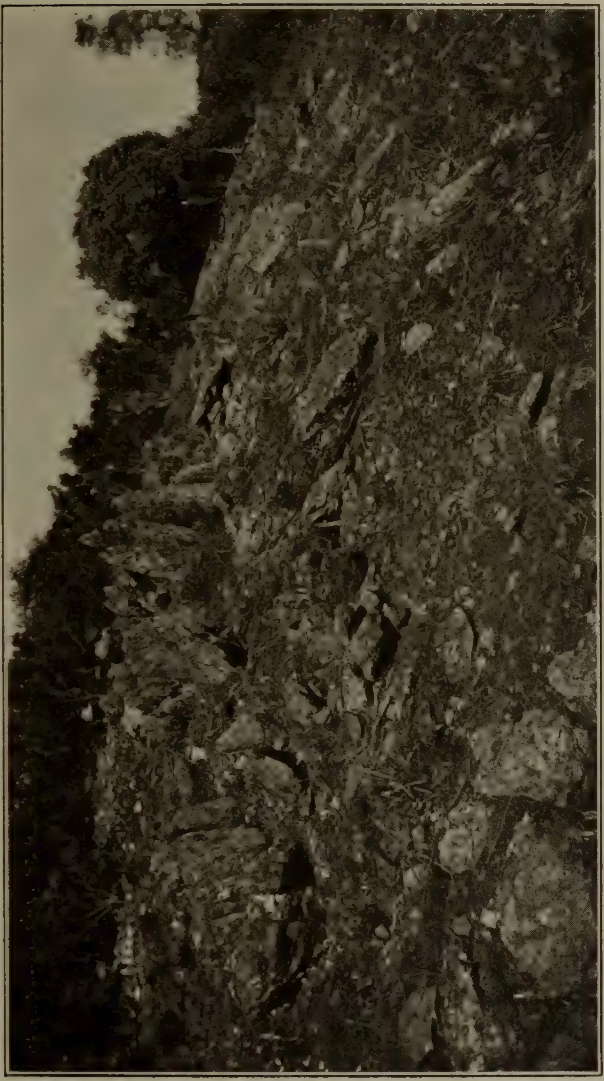
California Manganese Company Mine. Consists of five unpatented claims and 2160 acres of patented land located in Secs. 9, 11, 15, 21, 22, 27, 28, 33 and 34, T. 6 S., R. 5 E., about 35 miles from Livermore by wagon road. Most of this property is in Stanislaus County but a little is across the border and in Santa Clara County. The manganese is in lenses between sandstone and quartzite and the ores are manganite and pyrolusite. The development consists of two tunnels, one 15 feet and the other 20 feet long, and open cuts. This property is 25 miles from Patterson on the Southern Pacific Railroad and a wagon road is contemplated that will connect the mine with this shipping point. There is very little mining equipment on the property.

Manganese Prospect. This is a prospect in Sec. 8, T. 6 S., R. 6 E., M. D. M., that has a little trenching done on it. Could not get any further information about it. (See U. S. G. S., Bull. No. 427, on manganese.)

OCHRE.

Yellow ochre is mined to a limited extent and a few hundred tons are shipped to San Francisco each year.

Voyle Ochre Mine. Located in Sec. 29, T. 1 S., R. 12 E., M. D. M., at Knights Ferry on the Stanislaus River. The mine is on unpatented land. A small tunnel 50 feet long has been run into the face of the hill, but there is no equipment. About 150 tons of yellow ochre are shipped to W. P. Fuller & Company each year. It is owned by the California Ochre Mining Company, 126 Mission street, San Francisco.



Manganese croppings on the property of the California Manganese Company, California.

Voyle Ochre Mine at Knights Ferry, owned by the California Ochre Mining Company, of San Francisco.

QUICKSILVER.

Adobe Valley Quicksilver Mine. This was formerly known as the Stanislaus Quicksilver mine and is now owned by E. P. Newhall, box 354, Livermore, and located in Secs. 23 and 24, T. 5 S., R. 5 E., M. D. M., about 24 miles from Westley on the Southern Pacific Railroad. The property consists of 960 acres of patented land. The development consists of a 180-foot double-compartment vertical shaft. The ore is said to average 0.8% quicksilver. There is no equipment and the mine has been idle for some years.

Newhall Quicksilver Mine. This was formerly known as the Deer Park Quicksilver mine, two thirds of which is owned by E. P. Newhall, and located in Secs. 31, 32, T. 5 S., R. 5 E., M. D. M., about 22 miles from Patterson. The property consists of eleven claims of 220 acres, upon which a little development work has been done, but it has been idle for years.

Phœnix Quicksilver Group. This was formerly known as the Summit and Grayson mines, owned by Mrs. Emma Rose, of New York, and located in Secs. 20, 21, 22 and 29, T. 6 S., R. 5 E., M. D. M., 24 miles from Patterson. There are seven patented claims, four millsites and

160 acres of timber land and also six unpatented claims. The mine is being retimbered and opened up by the owners. The Orestimba mine, of 2300 acres of patented land, also belongs to this group (see "The Quicksilver Resources of California," issued by the State Mining Bureau; also State Mineralogist Reports X and XIII).

SILICA.

There is some comparatively pure silica in ledge formation and also silica sand in the county suitable for glass manufacture, but at present it is a considerable distance from cheap transportation.

Croppings of silica, owned by the California Silica Company, of San Francisco.

California Silica Company. Consists of 40 acres located in the SE. ¼ of Sec. 4, T. 6 S., R. 6 E., M. D. M., 12 miles up El Puerto Creek from the town of Patterson. The analysis of the silica by George James Company, gives water 0.8%, iron none, and silica 99.2%. The analysis by Smith, Emery & Company gives silica 99.783%, alumina 0.21% and iron oxide 0.007%. Only assessment work has been done. The width of the vein is 5 to 20 feet.

Silica Sand. Located on a 320-acre patented piece in Sec. 20, T. 5 S., R. 7 E., M. D. M., and owned by J. J. Cummings and Thomas Wolf, 2231 Ashby avenue, Berkeley. The sand is said to be 97% to 99% pure in silica. It is very fine grained.

WATER.

This county is considered one of the best watered counties of the State and is served by five irrigating systems, as well as numerous wells sunk by individual farmers. Perhaps as an illustration of the ample supply of water that is obtained from wells, that of the city of Oakdale might be mentioned. This well is situated in the city limits and is 217 feet deep. The first 50 feet is walled up and the remainder of the well is cased with 10-inch casing. The well supplies, by pumping, enough water for the city's consumption, both domestic, street sprinkling and a swimming pool. Approximately 327,000 gallons are pumped every twelve hours during the summer months.

PART V.

The Counties of

San Diego, Imperial

By FREDERICK J. H. MERRILL, Ph.D., Field Assistant.

December, 1914

INTRODUCTION.

The county of San Diego and its former eastern extension, now known as Imperial County, comprise a section of southern California unique in climate, mineral resources and agricultural possibilities. The first of these subjects has become familiar to the tourist and health seeker and has had an important influence in building up the city of San Diego and the population of the surrounding country. The second, to which this report is devoted, is of great interest for its variety, and will be, in the future, as it has been in the past, a matter of substantial financial importance. The agricultural conditions are so inviting that they have attracted world-wide attention and have been so attentively considered that they need not be described in detail here.

The following report presents the result of nearly three months of field work in the two counties. In this limited time it was not possible to visit every locality, but, by combining the writer's personal observations on the principal properties with other data from reliable sources, all deposits, of any importance or interest, have received attention and are accurately recorded.

In discussing the resources of these two counties, it seems advisable to treat them in two separate chapters, though their union prior to 1907 and their intimate relation in geography and geology, make it necessary to refer frequently from one to the other. Articles on the geology and mineral resources of San Diego County, together with Imperial County, are to be found in many of the publications of the State Mining Bureau, and to them the reader is referred for a large amount of historic detail. Reference to these will be found in the bibliography at the end of this report.

Acknowledgments for important assistance rendered are due to General A. W. Vogdes, Messrs. C. E. Anthony, J. G. Naylor and W. H. Trenchard, of San Diego, to Mr. Walter Nordhoff, of National City, to Mr. D. F. Lane, of Julian, and to many others.

Dr. A. S. Eakle of the University of California has made petrographic determinations of a number of rocks from the granite quarries, from the gem localities and from the Dulzura gold belt.

CHAPTER I.

SAN DIEGO COUNTY.

HISTORY.

The region of San Diego was first made known to the civilized world by the discovery of its bay in September, 1542, by Juan Rodriguez Cabrillo. By the arrival there on June 16, 1769, of Padre Junipero Serra and the establishment in honor of San Diego de Alcala of the first Franciscan Mission in California, this place was fixed as an important landmark in the settlement of the Pacific coast, and claims special prominence in the history of the Golden State.

The county bearing this name, with a present area of 4,221 square miles and a population in 1910 of 61,665, was one of the original twenty-seven counties organized in 1851 by act of the state legislature. At that time it was of much greater extent, its area having been considerably diminished, in 1889, by the separation from it of a part of what is now Riverside County. In 1907 it was still further reduced by the organization of its eastern portion as a separate county under the name of Imperial.

PHYSIOGRAPHY.

The county is diversified in its physiography, its essential topographic features being an area some 50 miles broad, of parallel ranges of granite, with southeast trend, including the southeastern continuation of the San Jacinto Range of Riverside County. Among these granite ranges are valleys occupied by parallel belts of metamorphic rock, chiefly slate and mica schist, with some quartzite and limestone, having nearly vertical dip and northwest strike, and extending, with many interruptions by granite intrusions, from Mexico into Riverside and Orange counties. About 40 miles northeast of San Diego, in a belt extending northwest and southeast, the altitude of the ranges exceeds 5,000 feet at many points, and some mountains attain greater elevations, as follows: Palomar, 6,126 feet, Hot Springs Mountain 6,400 feet, Cuyamaca 6,515 feet and Laguna Mountain 6,500 feet. These last two are intrusions of diorite or gabbro which, as the geologic map shows, occur here and there in the granite area. Southwesterly from this elevated belt the altitudes decline toward the coast. On the seaward border of the granite, extending northwest some 40 miles from the Mexican line, but only a few miles wide, is an area of volcanic felsite and tuffs, for the most part buried beneath the mesa formations, but exposed at many points and forming the mountain peaks of Otay, San Miguel, Black Mountain and others. On the west flank of all the crystalline formations, lies an extensive mesa or plain of Tertiary deposits, prominent in the landscape near San Diego and gently sloping seaward, from an altitude of about 500 feet at its eastern margin, to an elevation of about 300 feet near the coast line. Thus, between La Mesa and La Jolla, its slope is about 20 feet per mile. From the main divide the surface slopes steeply eastward toward the Salton Basin, and here desert conditions prevail, since the precipitation mostly falls on the western slope.

Many observers have commented on the fact that the slope of the granite ranges is steeper toward the east than toward the west, for they rise abruptly some thousands of feet from the comparatively level and low lying Tertiary and Quaternary formations of the Salton Basin. Some have attributed their escarpments wholly to faulting, but, on examination of the region, it seems inadvisable to adopt this as the sole explanation. West of the Salton Basin, which is evidently in a syncline, though possibly on a fault line also, is an anticlinal area including minor synclines and having for its main axis, the granite of the peninsular range which trends nearly northwest. The northeast limb of this principal anticline is much steeper than the opposite one which declines toward the ocean. The various anticlinal and synclinal folds are intersected by parallel faults at right angles to their axes and consequently with northeast trend. These faults have cut the formation into blocks which pitch northwesterly. From the relation of the crystalline rock masses on the west side of the Salton Basin to the fossiliferous Miocene Tertiary beds it is evident that a local uplift of some 2,000 feet has occurred later than the Miocene period and probably in the Postpliocene and, to this uplift, in part, some of the more noticeable escarpments owe their present altitude.

GEOLOGY.

The following synopsis of the geology of the county is a brief résumé of what is known of its structure and history, no complete geologic survey having yet been made:

Under the first geological survey of California, conducted by Dr. John B. Trask from 1851 to 1856, no work was done in San Diego County.

In November and December, 1853, Mr. Wm. P. Blake, as geologist of the expedition under Lieut. R. S. Williamson, to determine a route for a transcontinental railroad, made a careful reconnaissance of the Salton Basin, and traversed the valley of Carrizo Creek through Vallecito to San Felipe and thence to San Diego. The results of his important work are to be found in volume V of the Reports of the Exploration, issued as Senate Document No. 78 of the Thirty-third Congress, second session. Prof. Wm. P. Blake also contributed to the Report of the Superintendent of the Coast Survey for 1855, pp. 376-398, an article entitled ''Observations on the Physical Geography and Geology of the Coast of California from Bodega Bay to San Diego.''

In December, 1857, in connection with the expedition for the exploration of the Colorado River under Lieut. J. C. Ives, Dr. J. S. Newberry crossed the country from San Diego to Yuma. His observations, made in this journey, are on pages 13–18 of the report of the expedition, which is House Document No. 90, of the Thirty-sixth Congress.

Under the Second Geological Survey of the State, in 1872, W. A. Goodyear made a reconnaissance of the county, but his notes were not published until 1888. See Eighth report State Mineralogist.

In 1882 H. G. Hanks, State Mineralogist, visited the Colorado River Desert, as described in the second report.

In 1892, H. W. Fairbanks made a reconnaissance of the county over its principal highways, and his accurate observations appear in the eleventh report.

In all of the reports subsequent to the fifth are published notes on the mineral resources, and these embody geological observations.

In the limited time allotted to the writer for a study of the mineral resources of the county, he has noted all geologic details which came within his observation in visiting the chief areas of production. The sum total of all these observations, combined with facts gleaned in the study of neighboring areas, gives opportunity for a fairly accurate résumé.

It is hoped that the following review of the geology will have a stimulating effect on teachers and students within the county and in its neighborhood, and lead them to make further contributions to our knowledge of the structure of the region.

Table of Geologic Formations in Southern California.*

Period			Subdivisions	Local
	Pleistocene		San Pedro	Fernando
Cenozoic, Tertiary	Pliocene		San Diego	
	Miocene	Upper	San Pablo	
			Santa Margarita	
		Lower	Monterey	Modelo Puente
			Vaqueros	
	Oligocene		Sespe	
	Eocene		Tejon Martinez	
Mesozoic	Cretaceous		Chico	
	Lower Cretaceous, Comanchean		Horsetown Knoxville	
	Jurassic		Franciscan	San Luis
	Triassic			Santa Ana
Palæozoic	Carbonic and possibly older		Calaveras	Julian?

*In part after Ralph Arnold. Bulletin Am. Inst. Min. Engineers, March, 1914, p. 406.

Historical Geology.

The general geologic history of this county, so far as it can at present be read and written, is as follows:

No Palæozoic sedimentary rocks in which fossils are preserved are known within the county, but from evidence collected at various points[1] concerning the metamorphic strata of the Mother Lode region and from Carbonic fossils[2] found in the Santa Ana Mountains of Orange County, we conclude that, as early as Carbonic time, and possibly earlier, shoal water conditions existed over parts of San Diego County, leading to the formation of extensive deposits of mud and sand, derived from the erosion of some adjacent continental area. These beds possibly rested on a basement of granitic material, though we are not certain of this, and in them, at intervals, thin deposits or lenses of carbonate of lime were formed. At some time subsequent to the Jurassic period, came an epoch of mountain building, during which the rock mass underlying the sediments, above mentioned, in a molten state and under great pressure; or granite from some other source, in a state of fusion, was forced upward in parallel zones of northwesterly trend. In this movement, through the attendant heat and pressure, the overlying sediments were metamorphosed, mud deposits becoming slate and mica schists, sand beds becoming quartzites and limestone being crystallized into marble. In addition, these beds were thrown into folds, anticlinal above the granite axes and synclinal in the troughs between, in the latter, the strata being so closely compressed as to stand nearly vertical. In the lapse of subsequent time, through long erosion, the metamorphosed sediments overlying the granite, have been worn away, leaving the igneous crystalline rocks uncovered in the principal mountain ranges; while the schists, slates, quartzites and limestones have been preserved in the valleys.

Subsequent to this period of mountain building, came a prolonged subsidence of the coast, during which, on the flanks of the upland, sedimentary beds were deposited in intermittent sequence from the Cretaceous through the Tertiary. As Miocene beds are not evident on the west slope, their deposition may have been interrupted by temporary emergence of the land. In the Salton Basin, however, the Miocene is represented by extensive clay deposits, well exposed in the region of Carrizo Creek and bearing proof of their age in the very noticeable bed of Miocene oyster shells (*Ostrea vespertina,* Con.) which caps them.

At the close of Miocene time, after attaining a maximum of 1,500 feet or more on the coast and 2,000 feet or more in the Salton Basin, the subsidence in the latter was suspended while that of the coast continued into Pleistocene time. Then began a gradual emergence causing the deposits formed during the submergence to be exposed to wave action at successive levels, for the rise of the continental margin was not continuous but intermittent. In the periods of no movement or of less movement, were cut and formed the various mesas, sea terraces and shore lines, which are so conspicuous in the scenery of the coast of southern California. The unequal height of some of these terrace planes shows that the movement was not everywhere the same. The elevation of the land progressed considerably beyond its present limit, and evidence from various sources indicates that the continental margin rose 800 to 1,000 feet higher than it stands at present and since then has gradually subsided. Evidence of the latter movement is seen everywhere along the coast of San Diego County, in the drowned stream valleys, often occupied by salt marshes. Of the periods of volcanic activity little is known except that considerable material of igneous origin has been deposited.

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[1] See Mother Lode Folio, U S. Geological Survey. Also San Luis Folio, U. S. Geological Survey.

[2] H. W. Fairbanks, R. XI, p. 116. Later studies of these fossils suggest their Triassic age, and modify our views concerning the Santa Ana metamorphic strata.

Structural Geology.

The formations of San Diego County are granites and other igneous crystalline rocks of several ages, metamorphic strata of great age, possibly Carbonic or older, and sandstones, shales, conglomerates, sands, gravel and clays of Mesozoic and Tertiary age.

The granites upon which the metamorphic rocks rest and by which they are intruded, are of several types, some of which Dr. A. S. Eakle has identified and his descriptions will be found under the various quarries. These granites in turn are intruded here and there by basic rocks of the diorite and gabbro types. The latter are cut, at many points, by pegmatite dikes which also sometimes appear as intrusives in the schists and in the granites. Two areas of these basic intrusives form substantial mountain ranges, one traversing the Cuyamaca Grant from north to south, and forming three peaks, of which the southernmost, 6,515 feet high, is known as Mt. Cuyamaca. Ten miles southeast, is the diorite ridge, known as Laguna Mountain, of which the summit attains an altitude of over 6,500 feet.

On the southwest flank of the granites is a volcanic area, a few miles wide, extending northwest some 40 miles from the Mexican boundary and often erroneously called ''the porphyry dike.'' This is largely overlain by the Tertiary formations. The principal rocks exposed are felsite, quarried for crushed stone at Spring Valley and Sweetwater Dam. With these, at various points, are tufas and volcanic conglomerates. The age of these volcanics is as yet somewhat indeterminate, but the specimen from Lo Tengo oil well, of black shale cut by felsite, suggests a post-Jurassic age for the latter. Dr. A. S. Eakle has made a petrographic examination of the felsite from Spring Valley and Sweetwater, and his results are as follows:

Sweetwater quarry. Metarhyolite or felsite. A thin section shows a feldspathic polarizing base filled with needles of feldspar, showing flow structure and pale green chloritic matter filling the interstices. Patches of yellow granular epidote, as an alteration product, are frequent. A grayish opaque dust is sprinkled throughout.

Spring Valley. Felsite. A thin section shows a fine indeterminate feldspathic base of needles with considerable green chlorite and altered opaque material.

The felsites may belong to the same period of eruption as the volcanics of Coyote Mountain in Imperial County, which underlie the Miocene clays, but they are of different type, for the Coyote Mountain effusive rocks are basic and, though they are badly decayed and difficult to identify, were probably mostly andesites.

The latest of the volcanics are probably the lava flows capping Tertiary gravels, seen in this county near Jacumba, and reported by H. W. Fairbanks[1] as occurring on the Santa Rosa Grant in Riverside County. They also occur near the coast south of the Mexican boundary. With these flows are deposits of tufa and conglomerate.

The metamorphic formations are mica schists, slates, quartzites and limestone, the first being especially well exposed near Julian and the latter occurring in small areas at several points. These metamorphic rocks, from their structural position and lithologic characters, may be regarded as probably equivalent to the Calaveras group, described in the Mother Lode Folio of the U. S. Geological Survey and will here be designated as the Julian group. Their exact age is uncertain.

A specimen of the Julian schist has been determined by Dr. Eakle as muscovite-schist. A thin section shows much quartz and slender frayed rods of muscovite. Much magnetite in grains and irregular masses, considerable limonite stains and an occasional apatite prism are seen.

The oldest unaltered sedimentary rock in the county appears to be a black slate which has been encountered in the Balboa, Lo Tengo and Otay oil wells and is exposed on the north slope of Mount San Miguel, on the west margin of the granite. A similar rock is found south of Dulzura in section 22. Here it contains a deposit of jasper. Lithologically it is similar to the material of the San Luis formation which has been identified in San Luis Obispo County as Franciscan or Jurassic (*see* San Luis Folio, U. S. Geological Survey). A fragment from the Otay well contained a small *Avicula*. Small outcrops of limestone are reported further northwest.

The Cretaceous strata exposed in this region are of the Chico series and appear in the bluffs on Point Loma and at La Jolla as described by Fairbanks.[2] Near the reservoir above La Jolla a specimen of *Inoceramus whitneyi* was found, which is now in the Chamber of Commerce Museum at San Diego.

As to the Tertiary, while the fossiliferous beds in and near San Diego are chiefly Pliocene, Eocene fossils have been found in Rose Canyon, and, according to Fairbanks,[2] on Point Loma. Miocene deposits have not yet been identified west of the divide, but are well developed in the Salton Basin.

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[1] Report XI, p. 101 *et seq.*
[2] Report XI, p. 95.

The Pliocene and Pleistocene formations, in stratigraphy and palæontology, have been fully described by Ralph Arnold.[3] To the average observer their chief physical character is manifest in their uniform surfaces which are known as *mesas* and therefore these merit the following description.

Mesa Formations.

As mentioned under Physiography, a prominent feature of the coastal region of the county, especially in the southwest, is the Mesa, a broad, elevated plain, gently sloping and deeply cut by stream valleys. To the layman this mesa is chiefly apparent by its relatively even surface with, here and there, a slight hummock or elevation, rising above its plane.

The Mesa and Mission Valley, Looking Northeast. F.J.H.M. Photo.

The geologist, however, also considers its materials as exposed in the banks of ravines and canyons and in cuts made in building roads. The superficial material, exposed from La Mesa westward along the side of Mission Valley and its tributaries, is seen to be chiefly a loosely cemented conglomerate 6 to 10 feet thick, underlain by finer materials of a sandy or clayey character.

On more careful investigation, the Mesa formations are resolved into two divisions: (1) An older mesa, much dissected by erosion, and largely washed away, the remnants of which, at the mouth of El Cajon Valley, reach a height of about 650 feet, and much greater altitude farther northwest; (2) A younger and less eroded mesa, of lower altitude, reaching in the same vicinity, a height of about 475 feet. The latter is the principal feature of the landscape within 10 miles of the coast in the neighborhood of San Diego.

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[2] Report XI, p. 95.

[3] Palæontology and Stratigraphy of the Marine Pliocene and Pleistocene of San Pedro, Cal. Mem. Cal. Acad. of Sc. Vol. III, 1903. Tertiary and Quaternary Pectens of California, U. S. Geol. Survey, Professional Paper No. 47, 1906.

These mesas are remnants of waved-formed terrace plains, developed at such successive intervals in Tertiary time. The upper is probably Pliocene, while the lower may have been formed in the Pleistocene. The shore line of the latter is mainly carved on the deposits of the older mesa, though in places, it rests on the crystalline rocks which underline them both. The shoreline of the older mesa is quite irregular, extending into the reentrant of El Cajon Valley and into those of Escondido, San Bernardo and others. Its level is marked by patches of loose material and conglomerate on the valley sides and on the hills within the valley, their uniformity of level and material, denoting their common origin. As stated, near Grossmont, the height of a fragment of the older mesa is about 650 feet. On the road to Poway a similar formation exceeds 1,000 feet. In the Escondido Valley it reaches 1,200 feet, and near the north line of the county it is still higher.

The Mesa and Mission Valley, Looking Northwest. F.J.H.M. Photo.

The elevation of the land or change of sea level, which raised the older mesa above the waves was much greater toward the northwest. At the national boundary the two mesas approximately coincide in level at about 500 feet above tide. On the other hand the younger or principal mesa seems to have its greatest elevation to the south. The Otay mesa has a surface height of 500 feet, while south of the Mexican boundary, the corresponding plain is higher.[4] Northwesterly its height declines until, near Oceanside, the principal mesa level seems to be about 300 feet.*

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[4] W. A. Goodyear, R. VIII, p. 518.

*For other observations see A. C. Lawson, Postpliocene Diastrophism of the Coast of So. Cal., Bull. Dept. Geol. Univ. of Cal., Dec. 1893.

GEOLOGIC MAPS.

The map prepared in 1893 by H. W. Fairbanks, to accompany his report on the geology of San Diego and Riverside counties, published in the eleventh report of the State Mineralogist, is very accurate in its general expression of structure. The Geologic Map of North America, issued in 1912 by the U. S. Geological Survey, while in general correct, shows a subdivision of the Tertiary formations of the costal area of this county, which will not be attempted here since, in this region, the mapping of Tertiary boundaries is not at present possible.

TOPOGRAPHIC MAPS.

The topographic work of the U. S. Geological Survey has been carried over the larger part of San Diego County, extending from the coast line east to the meridian of 116° 30′ west longitude, which nearly coincides with the line between ranges 4 and 5 east of the San Bernardino meridian. The sheets or quadrangles covering this area are San Luis Rey, Ramona and Cuyamaca on the scale of 1 ÷ 125,000 or about ½ mile = 1 inch, and San Diego and La Jolla on the scale of 1 ÷ 62,500 or nearly 1 mile = 1 inch. Also, within the San Luis Rey quadrangle, are two on the larger scale known as the Oceanside and Escondido quadrangles, and within the Cuyamaca quadrangle, is one on the larger scale, known as El Cajon. Beyond these, the Indio Special Map, scale 1 ÷ 125,000, covers townships 9 and 10 south in ranges 5, 6, 7 and 8 east, San Bernardino meridian. Further, all the region west of longitude 116° 30′, or range 5 east, is shown on a map known as Southern California Sheet No. 2, on the scale of 1 ÷ 250,000, or nearly 1 mile = ¼ inch. A map of the whole county on the scale 1 ÷ 125,000 has been carefully compiled under the direction of the county surveyor, Mr. James Butler, and several other county maps are for sale by local dealers in San Diego, which have been mainly compiled from the sources above mentioned.

In compiling bases for the economic map, accompanying this report, the writer has used the work of the U. S. Geological Survey as far as it extended, and has followed the map of Mr. Butler for the eastern section. The detail of Imperial County has been largely taken from the Imperial County map prepared under the direction of Mr. C. N. Perry, county surveyor, and some topographic detail has been taken from the U. S. Geological Survey Sheet, known as A Reconnaissance Map of the Salton Sink. The township plats in the U. S. Land Office at Los Angeles have also been consulted.

The purpose of the map, accompanying this report, which is on the scale of 4 miles to 1 inch, is to show the configuration of the surface and the drainage, the lines of transportation by water, by steam railway or by motor truck and wagon and, more particularly, the exact location of all mineral deposits of economic interest, whether at present being worked or lying idle.

MINERAL RESOURCES.

GENERAL.

The following pages give a concise summary of the mineral resources of the county, based on all accurate information previously on record and supplemented by additional detail obtained by the writer in his survey of the principal mineral areas. Since the time available for field work was limited, the detailed study of some specially important deposits has necessarily been left to future investigation. At the present time, the mineral production of this county is more important in non-metallic minerals than in metals. This is due, both to the decline of gold mining and to the growth of the city of San Diego and neighboring settlements, which has led to the discovery and development of extensive deposits of materials used in construction and in the industrial arts. To a large extent, the mineral resources of this county are dormant, through lack of transportation.

THE METALS.

Though, at present, they are less important commercially, it seems advisable to discuss first the metallic minerals known in the county, beginning with that precious metal, of which the discovery in California, led so early to the development of our Pacific coast. Deposits of several other metals have long been known in the county, but have not been described in the annual and biennial reports. The discussion of the metals will be given in the following order:

1. Gold
2. Copper
3. Silver
4. Lead
5. Zinc
6. Iron
7. Manganese
8. Molybdenum
9. Antimony
10. Bismuth
11. Tin
12. Nickel
13. Tungsten

GOLD.

This precious metal is found at many points in San Diego County and has, unquestionably, been known since a very early period of occupation; but its deposits, while in many cases, richly productive, at the time of their discovery, have not been continuously operated. The gold production of this county, though in the past amounting to several millions of dollars, is at present entirely suspended. Further, the present depression in all branches of the mining industry and the difficulty of finding capital for the development of small mines, has discouraged prospectors and but little new work is being attempted.

On some old unpatented claims, assessment work is still being done, some patented properties are being explored, in a limited way, and a few new claims are being developed. Near Julian, by individual effort, a small amount of ore is being produced. Since many properties appear quite limited in the extent of their ore deposits, it is not probable that many large mines will be found in this county, or be developed in the future; yet, several properties would well justify systematic exploration under expert supervision. It should be appreciated, also, that some mines have been and may continue to be, in the future, satisfactorily profitable under economical management at the hands of their owners, which might not be sufficiently productive to bear the heavier expense of operation by a corporation.

For previous records of gold mining in this county and in Imperial, see the following publications of the State Mining Bureau:

Report VI, Pt. 1, 1886, pp. 80–90;
Report VIII, 1889, pp. 512–516;
Report IX, 1889, pp. 139–154;
Report X, 1890, pp. 540–544;
Report XI, 1892, pp. 376–387;
Report XII, 1896, pp. 237–243;
Report XIII, 1896, pp. 331–341;
Register of Mines and Minerals, San Diego County, 1902.

Also, see Mineral Resources of the U. S.; U. S. Geological Survey. For records prior to 1886, see reports of R. W. Raymond, U. S. Commissioner of Mining Statistics, 1871–1885.

GOLD DISTRICTS.

The principal gold belt, lying in ranges 2, 3, 4 and 5 east, extends southward through a distance of 45 miles, from the Rice or Montezuma district, east of Warner's, to the Mexican boundary. The focus of mineralization appears to have been near Julian and Banner. In the Cuyamaca Grant are several prospects besides the historic and once richly productive Stonewall mine. At Deer Park, Pine Valley and Descanso are a number of gold mining claims, as well as west of the Cuyamaca Grant on Boulder Creek. Nearer the coast, in the vicinity of Escondido, are several prospects and two mines which have been productive. In the south considerable development work has been done near Dulzura and small prospects have been opened near Tecate, Campo and Jacumba. The chief placer in the county is in the Ballena Valley, east of Ramona, and, though not known to have been worked extensively, it is said to have been proven throughout a distance of some 8 miles. Small placers have been worked at many other places, since many gulches have yielded placer gold in the vicinity of gold bearing veins and, also, in areas where no substantial veins have been found.

The districts will be discussed in the following geographic order:

Northern Border.
Montezuma or Rice.
Grapevine.
Mesa Grande.
Escondido.
Ballena.
Julian.
Granite Mountain.
Oriflamme.
Stonewall.
Boulder Creek.
Deer Park.
Pine Valley.
Descanso.
Dulzura.
Mexican Border.

These districts are all shown on the Economic Map and the individual claims at Julian are shown on the map of that district.

THE NORTHERN BORDER.

Gold has been found in small quantities along the Riverside County boundary at many points. Most of the discoveries are placer deposits and have been chiefly of interest to Indians who have worked, in a small way, in the rainy season. Two of the more important localities are near Fall Brook and near the Temecula or Pechunga Indian Reservation.

MONTEZUMA, OR RICE DISTRICT.

This district, opened about 1896, is about 12 miles north of Banner and 6 miles easterly from Warner's on the slope of San Ysidro Mountain. In the thirteenth report, page 334, it was incorrectly described as east of Banner. The formations are metamorphic, consisting of mica schist, gneiss, quartzite and limestone, and are adjacent to a large granite area. The veins strike north 65° east and dip 70° northwesterly, and are in well-defined fissures, which cut the rocks both in strike and dip. The principal properties are controlled and operated by the Montezuma Gold Mining Company, 506 Timken Bldg., San Diego; H. W. Preston, president and general manager; F. W. Nash, secretary.

Most of the old Rice properties mentioned in R. XIII, pp. 332–345, have been relocated under new names, and several new claims have been added. At present the group comprises: Lost Mine, Granite, Combination, Sunset, Storm, Gold Bar, Virginia, Alta Vista, Eureka, Morning Star, Silver Moon, Red Chief and Bummer. The principal workings and camp are on Eureka and Morning Star.

This company has been carrying on development for about three years and had equipped the property with a mill which was burned in September, 1913. Work has been carried to a depth of 230 feet and aggregates 2,000 feet.

H. Galbraith of Warner's Springs controls the Buckeye group in the same vicinity, consisting of the following claims: Joker, on the Montezuma Vein, Warrior's Mark, Buckeye, Hillside Extension, North Star, East Star, and A. Y. Also the Maid of Erin group, comprising four claims 1, 2, 3 and 4; two on Lost Boy ledge and two on Swastika ledge. Frank Burton of Ramona owns the Swastika claim.

GRAPEVINE DISTRICT.

This camp is about 5 miles southeast of the Rice District and 16 miles from Warner's Springs. The principal property was formerly known as the Dewey Mine, and was opened about 1903. It was equipped with a mill which was never used. At present the chief claim is known as the Ready Relief and controlled by the Colorado Mining and Milling Company—J. A. Heath, San Diego, president, and Fred Wilson, San Diego, secretary. Fred Blethen of Warner's Springs is superintendent. Development work consists of a 100-foot shaft and a cross cut. A tunnel 975 feet cuts the vein at 200 feet. Two other tunnels are 75 feet and 30 feet, respectively. The vein is stated to be from 4 to 8 feet wide. At present only assessment work is being done.

MESA GRANDE.

This small district was at one time, quite productive, but has been idle for nearly twenty years. It is 65 miles northeast of San Diego and 15 miles northwest of Julian, in the same zone of mica schist. The principal claims are as follows:

Black Eagle. R. XI, p. 382; XII, p. 238. One mile northeast of the Rancheria, 20-foot shaft and some superficial workings. When first discovered the quartz was rich in gold. Owner, Ed. Hinkle, San Diego.

Shenandoah. R. XI, p. 382; XII, p. 242. One and a half miles northeast of the Rancheria. Elevation 3,200 feet. Shaft 175 feet. Steam hoist and 5-stamp mill. Owner, San Diego Business College, San Diego.

Gold Cliff. Has only superficial work.

Red Hill and *Hillside* are other claims long idle. The first is owned by Martin Steenbock and Vance Angel, Mesa Grande.

Wild Cat is a claim owned by Fred Scholder, Mesa Grande.

ESCONDIDO.

In the vicinity of this city, many gold prospects have been opened in the past, and some twenty years ago considerable activity was displayed. But, out of many properties, only two, the Escondido and the Oro Fino, became producing mines and at present all are idle.

It appears that about 1895 there was much prospecting done in this region, and the industry of many prospectors led to the opening of cuts, tunnels and shafts in a score of places. Some eighteen properties were opened but many of them were soon abandoned and some of them are unknown. The Register of Mines and Minerals for San Diego County, issued in 1902, mentions only the Oro Fino; but the Escondido also was probably then in operation. According to the record, thirteenth report, pages 331-347, exploration work in this vicinity was done in five areas, and the claims formerly located may be arranged geographically in the following groups:

I. North, 4 miles. White Oak, La Condado. *Abandoned.*
II. Northeast, 3 to 6 miles. Moe, Monarch, Geneva, Bottle Peak. *Abandoned.*
III. East, 3 to 4 miles. Bloodstone. *Abandoned.*
IV. Southeast, about 2 miles. Escondido, Oro Fino, Cravath. *The only productive area.*
V. Southwest and west in a zone extending from 3 to 9 miles. A number of prospects, showing both gold and copper.

Details of the abandoned claims are to be found in the thirteenth report, pages 331-346. Concerning the others, some additional facts are herewith given.

Group IV. Cleveland-Pacific Mining Co.

Escondido Mine. R. VIII, 524; XI, 382; XII, 240; XIII, 336. Two miles southeast of the city in Lots 2 and 4 of Block 257, and Lot 4 of Block 188. This mine is on the Rincon del Diablo Grant, purchased in 1884, by the Escondido Town and Land Company. From an early period of American occupation it was known as an *antigua,* that is, a property operated by early Spaniards or Mexicans, as evidenced by ancient workings.

About 1868 it was worked by Americans with an arrastre. After several changes in ownership, it was taken up in 1897 by the Cleveland–Pacific Mining Company, which operated for several years, and it has been on record as a producer, Mineral Resources of the U. S.; U. S. Geological Survey, 1907–09; but since 1911 it has been shut down. The corporation is represented by W. F. Speith, manager, 9283 Hough Court, Cleveland, Ohio.

Head Frame. Cleveland-Pacific Mine, Escondido. F.J.H.M. Photo.

The country rock is diorite and the ore is quartz; the vein varying from a few inches to 3 feet in width. Its strike is about north 40° east and the dip about 50° westerly. The deepest workings have a depth of 270 feet. Drifts on the vein amount to about 500 feet.

The equipment consists of two steam hoists and a mill of 5 stamps, with plates for amalgamation, a Wilfley table and two 10-foot cyanide tanks.

Dr. A. S. Eakle determines the wall rock here as granodiorite. A thin section shows much plagioclase, a little orthoclase and quartz, large plates of green hornblende, a few needles or prisms of apatite, and a little magnetite.

Oro Fino. R. XII, 242; XIII, 343. Two miles southeast, Lots 5 and 7 of Block 188.

This mine is about one quarter mile northeast of the preceding, in the same diorite and apparently on a parallel vein lying a little to the west. It has a mill of 5 stamps. It was operated for some years and has been a small producer, but since 1905 it has been idle. Owner, Mrs. O. J. Stough, San Diego. Depth of shaft, 330 feet. Drifts on the vein about 1,000 feet.

Cravath. R. VIII, 524; XI, 382; XII, 239; XIII, 334. Two miles southeast, Lot 2 in Block 321.

This property is about 200 yards northeast of the preceding, and is in the diorite, apparently on the Escondido fissure, the dip and strike of the vein being about the same.

The depth of the shaft is 100 feet. Only a short drift has been carried along the vein. But little work has been done and no production has yet been attained. No mill.

Owned in partnership by H. T. Robertson, $\frac{2}{3}$, and Louis Cassou, $\frac{1}{3}$, both of Escondido.

Group V.

The region west and southwest of Escondido lying between San Dieguito River and San Marcos Creek, throughout a range of hills in which are Mt. Whitney and Cerro de los Pozos, has been extensively prospected and many claims have been located. Most of these have a showing of copper in their outcrop.

Able. Seven miles southwest. R. XIII, p. 331. *Abandoned.*

Clifton. Nine miles southwest. R. XIII, p. 334. *Abandoned.*

Mountain Lion. Six miles southwest. R. XIII, p. 341. *Abandoned.*

Jolly Boy. R. XIII, p. 340. This lies in section 7, township 13 south, range 2 west, together with the claims known as B. S., *Oxide, Mars, Cora B.* and *Sunnyside.* The owners are A. W. Pray, H. H. Case, D. Crise and Cora B. Hall, all of Escondido, who have pooled their interests and hold the claims as a group. But little work has yet been done on them.

Coyote. R. XIII, p. 334. This was a group of four claims, first located in 1896, subsequently abandoned and relocated in 1913, by Peter Schnack of Escondido, under the names *Redrock; R. Extension No. 1; R. Extension No. 2, and R. Extension No. 3.* They lie in section 1, township 13 south, range 3 west, extending diagonally across the section from southeast to northwest. The ore body is in diorite and is said to be about 10 feet wide on the outcrop. It is opened by an incline 225 feet deep.

BALLENA PLACER.

This deposit of auriferous gravel, lying southeast and east of Ramona and first described by H. W. Fairbanks (R. XI, p. 91), is an old river bed with southwesterly trend, belonging to a system of drainage now extinct and possibly of Tertiary age. The gold may have come from the region about Julian. While these gravels have yielded values through a distance of 6 to 8 miles, one of the best areas comprises parts of sections 17, 18, 19, 20 and 21 of T. 13 S., R. 2 E. This ground is now controlled by C. F. Willard, of Ramona. Pay gravel also occurs in the adjoining School Section No. 16. The deposit probably extends south into the San Vicente Grant.

The history and production of this placer are obscure. From the earliest times Mexicans and Indians have worked this ground during the rainy season, when water was available, and there is no doubt that the production has been substantial.

As often happens, some parts of this placer are quite rich and values of $1.50 or more per yard have been reported. While those interested have investigated this deposit with very satisfactory results, there has, however, been no systematic sampling to determine the average value of any substantial area. To accomplish this, it would be necessary to survey the ground, divide it up into squares of convenient size, sink holes or pits at regular intervals and carefully sample the gravel from each opening.

At present such work is not within the scope of the State Mining Bureau, so that little can be said, based on official information. It was long supposed that, as this gravel lay above the present drainage lines, it would be necessary to bring in water from some higher level to wash the gravel. Accordingly a plan was undertaken some years ago to divert some water from the Santa Ysabel Valley and bring it to the Ballena placer through a long ditch. This enterprise was terminated by an injunction obtained by ranchers in the San Pasqual Valley.

Mr. C. F. Willard, who has long been interested in this ground, claims that his investigations establish the fact of an underflow of water in the gravel sufficient to float a dredge.

It seems to be established that a very substantial thickness of gravel exists here, claimed to average 30 feet, with no barren overburden, and it is stated by the owner that values will average 30 cents per yard without reckoning the richer streaks and channels. Undoubtedly in the near future, when industrial conditions improve, this placer will attract the attention of substantial capital and receive the expert examination it deserves.

JULIAN.

This district, which includes Banner, is 55 miles northeast of San Diego, by county highway, and about 35 miles from the railway at Foster.

History.

Gold has been known here since a very early period, and placers were worked in neighboring gulches for some years before the precious metal was found in veins. The first vein discovery is said to have been made late in 1869 on what was afterward the Van Wert claim. On February 22, 1870, another vein was discovered and a claim located on it under the name of Washington. From 1870 to 1880 there was great activity in this district and the production of gold is estimated at over $2,500,000.00.

The conditions in the camp during its Bonanza days, are more a matter of tradition than of history. The State Mining Bureau had not yet been organized and there was no public officer charged with the duty of making a careful record of existing conditions. At that time, however, Dr. R. W. Raymond was acting for the Federal Government as U. S. Commissioner of Mining Statistics, and many details of the discoveries and operations at Julian will be found in his annual reports beginning with the third, dated 1871, and running through the next succeeding volumes. These reports were issued as Executive Documents of Congress, and are to be found in most public libraries. In behalf of the State Mining Bureau, Mr. H. G. Hanks, State Mineralogist, visited Julian in 1886, Mr. W. A. Goodyear reported briefly on it in 1888 and 1889, and Mr. E. B. Preston was there in 1890. In 1892, 1894 and 1896 Mr. W. H. Storms visited the camp and recorded all facts available concerning the properties and their equipment. In 1902 Mr. E. Hubon reported on the details of the properties for the Register of Mines and Minerals. Some statistics of production in this camp will be found in the volumes on Mineral Resources of the United States issued by the U. S. Geological Survey. At the outset of the early operations a substantial zone of secondary enrichment was found, close to the surface, and much rich ore was taken out, some of it having been sold to jewelers for manufacturing purposes. In the course of time these veins were worked down to water level, the free milling ore became exhausted, and, with the appearance of sulphide ores, the values became reduced, and, the metallurgy more difficult, especially as in some mines the ore contains arsenic. Moreover, as the mines grew deeper, those not opened by tunnel were obliged to add, to the cost of mining, the expense of pumping water, for this district has a rainfall of over 30 inches per year.

At present the camp is very quiet, though many owners are keeping up assessment work in hope that financial conditions may change and that mining properties may again become saleable. Many properties are now inaccessible owing to water in the workings, or to caves, so that little can be seen and little added to what has already been published in the reports of this Bureau, to which the reader is referred for many details which can not now be secured. The principal references are as follows: R. VI, Pt. 1, pp. 85–87; R. VIII, pp. 513–519; R. IX, pp. 143–147; R. X, pp. 541–544; R. XI, pp. 376–381; R. XII, pp. 237–243; R. XIII, pp. 331–347; Register of Mines and Minerals, San Diego County, 1902.

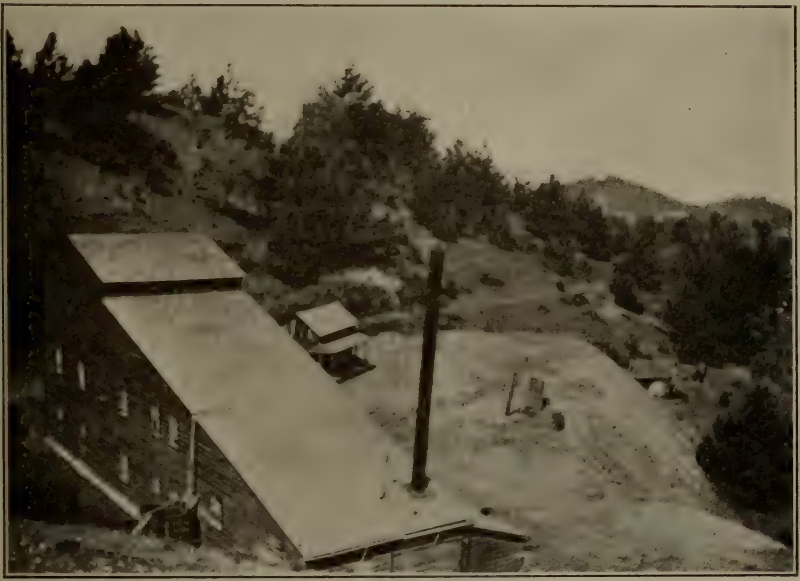
Geology.

The geology of this district is comparatively simple. The country rock, nearly everywhere, is a metamorphic slate or mica schist, with northwesterly strike and nearly vertical dip, which has been already described and provisionally assigned to the Calaveras group. Here and there, it contains small beds of quartzite which have been used in building house foundations. At some points, it has been injected with granitic matter in thin sheets parallel to the foliation of the schist. When this occurs, a rock results which closely resembles a granite gneiss. Small intrusive areas of granite also appear.

The mineralization of this area is in fissure veins of quartz which, both in dip and strike, are generally parallel to the schistosity of the country rock. These veins are essentially "stringer leads" and are usually small in width, following the curving strike of the schists as they swing westward toward Julian. Several parallel veins have been recognized, four of which have been regarded as continuous for several miles. The easternmost was known as the Chariot vein, those succeeding to the westward being known as the Ready Relief, the Cable and the Ruby, from names of claims located on them. (See map.)

In geologic structure, we have at Julian a miniature "mother lode," and much valuable detail bearing on the geology of the veins there and the conditions under which they were formed will be found in various reports on the Mother Lode and particularly in the Mother Lode Folio of the U. S. Geological Survey.

On account of the extent of this district and in view of the probability that some of the claims will be reopened, it has seemed advisable to give a careful record of the ownership of the properties and their relative positions. Accordingly the following cross-referenced lists have been made of the claims and their owners and a map has been prepared showing the relative positions of the claims now in existence. Careful attention has been given to the preparation of the lists of claims and owners, for many claims have been sold, many have lapsed and been relocated, and a considerable number have been abandoned and forgotten. The map has been compiled by enlarging the topographical detail of a portion of the Ramona quadrangle of the U. S. Geological Survey, and adding the boundaries of the existing claims as shown on a map of the Julian District, made in 1891 by D. D. Bailey, J. Chamberlain, and W. A. Sickler. The topography is correct, as well as the relative positions of the claims. As to their exact dimensions, there may be some inaccuracies, on account of the many relocations which have occurred, but the map should be of much general value. It is inserted in the margin of the general map of San Diego and Imperial counties.



Shaft House and Dump. Owen's mine, Julian.

List of Mining Claims in Julian District.

Name of property	Map No.	Owner	Address
Aguajita*	125	Smoky City Gold Mining and Milling Company	Pittsburg, Pa.
Alpha*		Mrs. Rosie Jacoby	Los Angeles.
Antelope	96	D. D. Bailey	Julian.
Bedrock	95	Chas. Bacon	Julian.
Belmont	121	D. D. Bailey	Julian.
Blue Jay*	73	John McCain	Julian.
Cable	111	Venturina Mining and Milling Company	San Diego.
California	82	E. F. Bowen	Julian.
Carp	114	D. D. Bailey	Julian.
Chapparal	92	H. A. Landwehr	Los Angeles.
Chariot North	127	F. McN. Hamilton	San Francisco.
Cheerful Moments	99	Oro Blanco Mining Company	San Diego.
Chieftain	71	Martin Jacobs	Julian.
Cincinnati Belle	105	Oro Blanco Mining Company	San Diego.
Contact	101	E. F. Bowen	Julian.
Eagle	75	A. P. Frary	Julian.
El Dorado	91	E. F. Bowen	Julian.
Elevada*	124	Smoky City Gold Mining and Milling Company	Pittsburg, Pa.
Ella	81	E. F. Bowen	Julian.
Empire	102	R. Melrose	Julian.
Fountain	113	D. D. Bailey	Julian.
Fraction	107	Venturina Mining and Milling Company	San Diego.
Friday*†		Friday Copper Mining Company	San Diego.
Gardiner	87	Lincoln University	Lincoln, Neb.
Golden Chariot	128	Chariot Mill and Mining Company	San Francisco.
Golden Gem I	89	D. F. Lane	Julian.
Golden Gem II	88	D. F. Lane	Julian.
Golden Shamrock	93	H. A. Landwehr	Los Angeles.
Gold Drops, formerly Bloomfield	100	E. F. Bowen	Julian.
Gold King*	129	D. C. Collier & Co.	San Diego.
Gold Monster	112	D. D. Bailey	Julian.
Gold Queen*	130	D. C. Collier & Co.	San Julian.
Grand Central	84	L. A. Smith	Julian.
Hassayhampa	86	J. E. McGowan	Julian.
Helvetia*	85	H. A. Landwehr	Los Angeles.
Hidden Treasure	103	D. D. Bailey	Julian.
High Peak	76	H. A. Landwehr	Los Angeles.
High Peak, South	76a	H. A. Landwehr	Los Angeles.
Homestake	109	R. Melrose	Julian.
Howard	119	D. D. Bailey	Julian.
Hubbard North	120	G. W. Hazzard	San Diego.
Hubbard South	122	D. D. Bailey	Julian.
Ivanhoe	78	H. A. Landwehr	Los Angeles.
Janet, Owens W. Extension	68	H. A. Williams	Julian.
Kentuck S.	104	Oro Blanco Mining Company	San Diego.
Madden	98	Chas. Bacon	Julian.
Nip and Tuck	83	E. F. Bowen	Julian.
North Star		Robert Melrose	Julian.
Owens New*	72	H. A. Williams	Julian.
Owens Old*		H. A. Williams	Julian.
Padlock	97	F. Harriett Estate	Julian.
Point Loma	123	Chalmer Bailey	Julian.
Poor Man		Chalmer Bailey	Julian.
Pride of the West*		Rex B. Clark	San Diego.
Raindrop	115	D. D. Bailey	Julian.
Ranchita*	126	C. J. Couts	Vista.
Ready Relief*	117	D. D. Bailey	Julian.

*Patented.
†Copper and nickel.

List of Mining Claims in Julian District—Continued.

Name of property	Map No.	Owner	Address
Redman	110	D. D. Bailey	Julian.
Redman North	108	D. D. Bailey	Julian.
Richmond	90	D. C. Collier & Co.	San Diego.
Roosevelt	70	H. A. Landwehr	Los Angeles.
Rossland	77	H. A. Landwehr	Los Angeles.
Ruby	106	F. Harriett Estate	San Diego.
San Diego	80	H. A. Williams and W. R. Malone	Julian.
Stanley	118	R. Melrose	Julian.
Tom Paine	116	D. D. Bailey	Julian.
Tom Scott	69	Geo. R. Sawday	Witch Creek.
Townsite	79	H. A. Williams	Julian.
Warlock	94b	H. A. Landwehr	Los Angeles.
Warlock No. 2	94a	H. A. Landwehr	Los Angeles.
Warlock No. 3	94	H. A. Landwehr	Los Angeles.
Washington	74	F. Harriett Estate	San Diego.
Van Wert*	67	John McCain	Julian.

*Patented.

List of Julian mining claims arranged by owners. Data of development taken from publications of State Mining Bureau:

Chas. Bacon, Julian.

Bedrock.

Madden. R. VI, Pt. 1, p. 86; XII, p. 242; XIII, p. 341. Two veins, 1 foot. Strike NW. Dip SW. Shaft 200 feet. Tunnel 50 feet. Drifts 500 feet. Depth 125 feet.

Chalmer Bailey, Julian.

Point Loma.

Poorman.

D. D. Bailey, Julian.

Antelope. R. XI, p. 380; XII, p. 238; XIII, p. 331. Elevation 3,500 feet; 1 vein, 1½ feet. Strike NW. Dip SW. Tunnel 200 feet. Shaft 100 feet. Drifts 300 feet. Depth 150 feet.

Belmont.

Carp.

Fountain.

Gold Monster.

Hidden Treasure. R. XIII, p. 339; elevation 3,200 feet; 1 vein, 1½ feet. Strike NW. Dip SW. Tunnel 600 feet. Incline 60 feet. Drift 400 feet. Depth 175 feet. Extensive workings above the tunnel level.

Howard.

South Hubbard. R. VI, Pt. 1, p. 87; XI, p. 380; XIII, p. 345. Elevation, 3,000 feet; 1 vein, 12 inches wide. Strike NW. Dip 45° NE. Cross cut tunnel, 300 feet; strikes vein 200 feet below surface. Drifts 90 feet SW., 400 feet NW. A shaft connects adit level with surface. Depth, 275 feet.

Raindrop.

Ready Relief.[1] R. VI, Pt. 1, p. 87; VIII, p. 513; IX, p. 147; X, p. 543; XI, p. 378; XI, p. 378; XIII, p. 344. Elevation, 2,900 feet; 1 vein, 3 feet. Strike NW. Dip NE. This is the northward continuation of the South Hubbard vein. Shaft 200 feet. Incline 100 feet. Tunnel, 2,000 feet. Depth, 250 feet. Worked through 3 adits. Has 10 stamps. Water power mill.

Redman. R. VI, Pt. 1, p. 87; XI, p. 380; XIII, p. 344. Elevation 2,800 feet; 1 vein, 2 feet. Strike NW. Dip SW. North extension of Ready Relief. Vertical shaft 113 feet. Tunnel on vein 120 feet, cutting shaft 25 feet below surface. Total tunnel, 250 feet. Drifts, 300 feet. Depth, 150 feet.

North Redman.

Tom Paine.

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[1] Patented.

E. F. Bowen, Julian.

California. One vein, 6 inches. Strike NW. Dip SW. Shaft, 40 feet. Drifts, 30 feet.

Contact.

Ella. R. VI, Pt. 1, p. 85; XII, p. 239; XIII, p. 335. Elevation, 3,500 feet.

El Dorado. One vein, 6 inches, Strike NW. Dip SW. Open cut, 30 feet. Tunnel, 40 feet. Drift, 150 feet. Depth, 100 feet.

Gold Drops. Formerly Bloomfield.

Nip and Tuck. Formerly Lucky Ben.

Chariot Mill and Mining Co., 555 Mills Bldg., San Francisco. Adelaide Elliot, president; J. H. Isham, secretary.

Golden Chariot.[1] R. VI, Pt. 1, p. 86; IX, p. 147; XIII, p. 337.

R. B. Clark, San Diego.

Pride of the West. On patented land. Long abandoned as a mine.

D. C. Collier & Co., San Diego. C. A. Richardson, president; C. O. Reinhold, secretary.

Gold King.[1] R. VIII, p. 513; IX, p. 43; X, p. 543; XI, p. 381; XII, p. 241; XIII, p. 337. Elevation, 4,000 feet. Shaft with several levels. Mill at Banner.

Gold Queen.[1] R. XIII, p. 337. Elevation, 4,000 feet. Shaft 100 feet on vein in granite.

Richmond.

C. J. Couts, Vista.

Ranchita.[1] R. XIII, p. 334. Elevation, 3,300 feet. Country rock mica-schist. Strike NW. Dip 70° NE. Parallel irregular quartz lenses cut the strike of the schist at about 20°. These lenses seem to terminate on reaching a fault plane striking east and west. They are from 12 inches to 3 feet wide and are 4 feet to 5 feet apart for some distance along the mineralized zone. Incline shaft 145 feet. Several levels and extensive stopes.

A. P. Feary, et al.

Eagle. R. XIII, p. 335. Elevation, 4,200 feet. Developed by cross cut tunnel. Two veins, 1 foot wide. Strike NW. Shaft, 100 feet.

F. McN. Hamilton, San Francisco.

Chariot North.

Frank Harriett Estate, San Diego.

Padlock. Two veins, 2 feet wide. Strike NW. Dip SW Tunnel, 50 feet. Drifts, 200 feet. Depth, 100 feet.

Ruby. R. XI, p. 380; XIII, p. 345.

Washington. R. XII, p. 243; XIII, p. 345. Elevation, 4,200 feet. One vein, 1¾ feet wide. Strike NW. Dip SW. Shaft, 135 feet. Tunnel, 100 feet. Drifts, 100 feet.

G. W. Hazzard, *San Diego.*

North Hubbard. R. VI, Pt. 1, p. 87; XI, p. 380; XII, p. 241; XIII, p. 341. Elevation, 3,100 feet. One vein, 1½ feet. Strike NW. Dip NE. Cross cut tunnel, 580 feet. Drifts, 500 feet. Depth, 250 feet. Winze on superficial workings.

Martin Jacobs, Julian.

Chieftain.

Mrs. Rosie Jacoby, 1007 Lake street, Los Angeles.

Alpha.[1] This is stated to be no longer held as a mine.

H. A. Landwehr, 507 Union Oil Building, Los Angeles.

Now controls all mining claims formerly included in the Julian Consolidated, High Peak, Warlock and McAllister mining companies. Also the patented land in Sec. 32, T. 12 S., R. 4 E., consisting of the SW. ¼ of NW. ¼, N. ½ of SE. ¼, SW. ¼ of SE. ¼, SE. ¼ of NW. ¼, E. ½ of SW. ¼.

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[1] Patented.

The mining claims are in three groups as follows:

(*High Peak Group.* Five claims.)

Roosevelt.

Rossland. Formerly North Star.

High Peak. R. X, p. 542; XII, p. 241; XIII, p. 339. Elevation, 4,400 feet. Two veins, 1½ to 4 feet wide. Strike NW. Dip NE. Shaft, 330 feet. Tunnel, 375 feet. Drift, 1,300 feet.

South High Peak. Formerly Homestake.

Ivanhoe. Formerly Three Brothers.

Helvetia.[1] R. IX, p. 145; X, p. 542; XI, p. 376; XII, p. 241; XIII, p. 339. Vein. Strike NW. Dip NE.

(*Warlock Group.*)

Warlock. R. X, p. 544; XII, p. 243; XIII, p. 345. Elevation, 3,300 feet.

Chapparral. R. XII, p. 239; XIII, p. 334.

Warlock No. 2. Formerly Neptune.

Warlock No. 3. Formerly Hastings.

Golden Shamrock. Formerly Golden Rule.

D. F. Lane, Julian.

Golden Gem No. 1. Formerly Mammoth.

Golden Gem No. 2. Formerly Julian.

Lincoln University, Lincoln, Neb. E. J. Swayne, agent, San Diego, Cal.

Gardiner.[1]

J. E. McGowan, Julian.

Hassayhampa. Three veins, ½ foot to 2 feet wide. Strike NW. Dip NE. Tunnel, 265 feet. Winze, 100 feet. Drifts, 100 feet.

Robert Melrose, Julian.

Empire.

Homestake. Formerly Wilcox. R. XII, p. 243; XIII, p. 345. Elevation, 3,100 feet. Two veins, 6 inches to 18 inches wide. Strike NW. Dip SW. Open cut 78 feet. Tunnel, 600 feet. Depth, 150 feet.

Stanley.

North Star. R. XIII, p. 342. Elevation, 3.200 feet; 1½ miles SE. of Banner. Two veins 3 feet wide. Strike NW. Dip NE. On first, shaft 45 feet, drifts 40 feet and 28 feet on the vein. On second vein, shaft 115 feet.

Oro Blanco Mining Co., San Diego. D. C. Collier, president; C. A. Richardson, acting secretary, Union Building, San Diego.

Cincinnati Belle. R. XI, p. 380; XII, p. 239; XIII, p. 334. Elevation, 2,500 feet. Vertical shaft 230 feet deep. Steam hoist.

Kentuck S. R. X, p. 542; XI, p. 380; XII, p. 241; XIII, p. 340. Elevation, 3,400 feet. Shaft 97 feet, with stopes to the surface, now caved. A new tunnel 70 feet on a 6-inch vein. New shaft 100 feet, cut at 50 feet by adit.

Cheerful Moments. Formerly Sauerbrey.

George R. Sawday, Witch Creek.

Tom Scott. Two veins, 1½ feet wide. Strike NW. Dip NE. Shaft, 225 feet. Tunnel, 300 feet. Drifts, 220 feet. Depth, 225 feet.

L. A. Smith, Julian.

Grand Central. Vein ½ foot to 3 feet wide. Strike NW. Dip NE. Drifts, 200 feet. Depth, 50 feet.

Smoky City Gold Mining and Milling Company, Pittsburg, Pa.

Aguajita.[1]

Elevada.[1] R. XIII, p. 335. Elevation, 3,300 feet. Opened 1894. Vein Strike NW. Dip 60° SW. Shaft, 160 feet. Levels at 50 feet and 100 feet in vein 2 feet to 8 feet wide. Within this zone are 1, 2 and sometimes three veins carrying gold. At 100 feet a fault has displaced the vein.

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[1] Patented.

VENTURINA MINING AND MILLING CO. G. G. Wetherby, president, Los Angeles; Nat. Titus, secretary, 434 Union Building, San Diego.

Cable. R. XIII, pp. 332-333. Elevation, 1,300 feet. Development is on 3 adit levels respectively 217 feet, 160 feet and 330 feet long, the last being the lowest. Considerable stoping was done in the upper levels years ago and the lowest tunnel, which was driven to reach the shoot, encountered 2 separate shoots.

Fraction.

H. A. WILLIAMS, Julian.

Owens.[1] R. VI, Pt. 1, pp. 85-87; VIII, p. 519; IX, p. 144; X, p. 541; XII, p. 242; XIII, p. 343. Elevation, 4,200 feet. Shaft, 350 feet. 1,000 feet of drifts. Four veins, ½ foot to 6 feet wide. Strike NW. 10-stamp mill, steam hoist and Cornish pump. This property consists of 2 patented claims, each 300 feet wide, and designated as Old Owens and New Owens.

Janet. This claim is the west extension of the two Owens.

San Diego. R. XIII, p. 345. Elevation, 4,000 feet. Two veins, 4 feet wide. Incline shaft 70°, 125 feet. Tunnel, 200 feet.

Townsite. Formerly Fourth of July and America.

GRANITE MOUNTAIN.

This is about 10 miles southeasterly from Julian. Gold was discovered here about 1910. A group of seven claims has been located by W. K. Maull, of San Diego, on the slope of Granite Mountain, at an altitude of 4,100 feet. Their position is in township 13 south, range 5 east, near the section corner 15, 16, 21 and 22. The formation is mica schist and the gold values are in quartz veins. One of these is said to be 8 feet wide, another varies from 6 inches to 2 feet. The strike of the main vein is north 50° and the dip southwest. The development work consists of three tunnels, each about 70 feet long with 40 feet of back.

ORIFLAMME.

R. VI, Pt. 1, p. 89. XIII, p. 342.

This mine, 5 miles southwest of the preceding, is about 6 miles southeast of Banner and 4 miles due east of the Stonewall, in T. 14 S., R. 4 E. Sec. 1 and R. 5 E. Sec. 6. It has been idle for many years and very little is known about it. There was a 10-stamp mill in operation in 1886. Transportation is difficult and wood and water are scarce. The ore body is described as in mica schist 3 to 6 feet wide, 1 foot being very rich. The workings amount to 200 feet of tunnels and drifts. In 1902 the owners were J. S. Buck and S. F. Smith, of San Diego.

STONEWALL MINE.

R. VI, Pt. 1, p. 89; R. VIII, p. 515; R. IX, p. 143; R. X, p. 540; R. XI, p. 382; R. XII, p. 243; R. XIII, p. 345. Register, Mines and Minerals, 1902.

This property is part of the Cuyamaca Grant, owned by the Sather Bank of San Francisco, F. W. Woulfe, trustee. It is situated on the south bank of the Cuyamaca Reservoir.

The country rock is banded mica schist. The vein strikes north 35° west and dips 65° southwest. The mine was located about 1870 and was worked for about five years prior to 1891 by ex-Governor Waterman. A three-compartment shaft was sunk 600 feet and levels driven at 180 feet, 235 feet, 315 feet, 400 feet, 500 feet, 600 feet, north and south on the vein. The total production was about $2,000,000. Between 1888 and 1891 it amounted to $909,442, recorded by the U. S. Mint and the Sather Banking Company of San Francisco.

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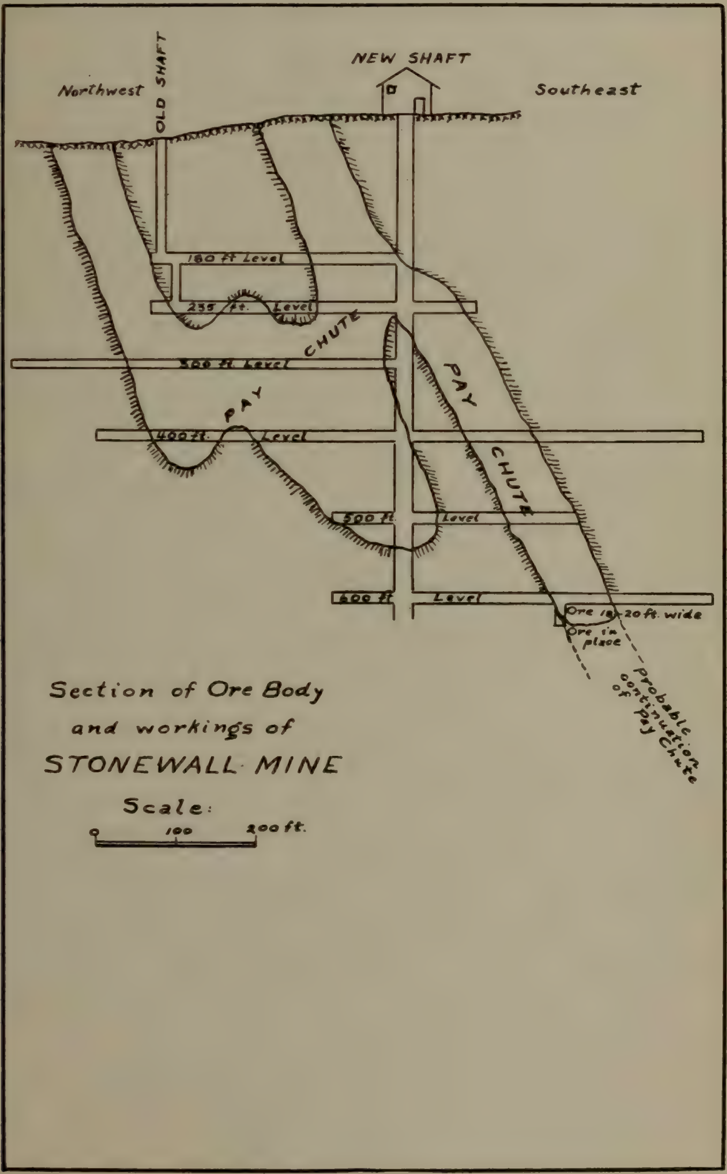
[1] Patented.

Through the courtesy of Mr. Frank Robbins, M.E., of Los Angeles, a section of the ore body is here given.



NOTE.—"Pay chute" above should read, "shoot."

The great production of the bonanza days came from a shoot some 300 feet long which was worked to a depth of 500 feet. Below this level the continuation of this shoot was greatly reduced in size and at the 600-foot level it was worked with a length of 90 feet. Below the 600-foot level a winze was sunk 30 feet, still in ore. The rake of the shoot is to the southeast. At 600 feet the vein is 87 feet from the shaft on the cross cut and the ore body is 160 feet southeast from the shaft on the vein. The ore in places attained a width of 20 feet.

Equipment: Buildings for all purposes; one double reel, hoisting engine 100 horsepower; 1 Ingersoll compressor for 3 drills; 20 stamps; 1 Corliss engine; 5 boilers, 200 horsepower; 1 20-horsepower donkey engine, 1 steam station pump, 2 sinking pumps, 2 water skips, 2 cages, aid drills and other tools.

BOULDER CREEK.

West of the Cuyamaca Grant, on the drainage channel known as Boulder Creek, some claims have been held for several years. There are now 10 of these: Punch Bowl, Little Giant, Condor, Quartzite No. 1, Quartzite No. 2, Apex, Cuyamaca, Golden Eagle, Nebraska and Golden Hill in sections 9 and 10, township 14 south, range 3 east. They are controlled by the Boulder Creek Consolidated Gold Mining and Milling Co., Thomas J. Fisher, President, San Diego; George H. Moyer, Lakeside, vice-president, J. H. Kleine, Lakeside, secretary.

The properties are developed by several hundred feet of tunnels and drifts and are equipped with a 10-ton roller mill and a concentrator.

DEER PARK.

On the east margin of the Cuyamaca Grant, in Sec. 31, T. 14 S., R. 5 E., and near a locality known as Deer Park, about 9 miles northeast of Descanso, are several gold prospects, which have long been known and worked from time to time without becoming producers. The principal of these were noted in R. XIII, page 332, as the Cascade, Combination, Corporal, Hermit, Matamore and Spike and were recorded as the property of John T. Beyers of Descanso. In 1896 they were equipped with a 2-stamp water power mill. In 1902 the Cascade and Independence, both in SE. ¼ of Sec. 31, were reported in the Register of Mines and Minerals, as belonging to Messrs. Saybold and Sunnocks of San Diego. At present these properties, relocated as You Bet, are controlled by Messrs. J. H. Schook of Descanso and J. L. Burns of San Diego. The title to them is in the Cascade Mining Company, Will D. Rudd, president; John L. Burns, secretary-treasurer, 311 Union Building, San Diego.

The present holdings of John T. Beyers are not definitely known, as he has not replied to the letters addressed to him. This region was not visited owing to lack of time and its detailed study has unavoidably been left to a future occasion. Several claims have been reported in this vicinity, but no definite information could be obtained concerning them. It is probable that some of them have been abandoned. Those definitely located as to position are as follows.

Name	Position	Reported owner	Address	Reference
Free Coinage Double Standard	S. 12, T. 15 S., R. 4 E.	E. Hawkes	San Diego	M. & M. R. XIII, p. 339
Hickory Jim	S. 5, T. 15 S., R. 5 E.	J. F. Neeley, Est.	San Diego	
Lone Jack Expansion	S. 31, T. 14 S., R. 5 E.	John T. Beyers	Descanso	

PINE VALLEY.

This district is on the west slope of the Laguna Range. A number of prospects have been opened in this neighborhood but the principal claims are those known as: THE NOBLE MINES. Report IX, p. 141; X, p. 544; XI, p. 382; XII, p. 238; XIII, p. 342. These are on the west slope of Laguna Mountain, about 9 miles east of Descanso, and the claims are known as Eureka, Treasury, Bay View, Spring, Spring No. 2, South End, Oxide, Mill Site, Telluride. They are in sections 7, 8 and 17, T. 15 S., R. 5 E., S. B. M. Oxide is in the southeast part of the NE. ¼ of Sec. 17; Mill Site in the southeast part of the NW. ¼ of Sec. 17.

Eureka. Tunnel No. 1, 150 feet, 60 feet below surface on lode. Tunnel No. 2, 350 feet, 150 feet below No. 1, partly cross cut, partly on lode. Shaft at mouth of Tunnel No. 1, 100 feet. Drifts at 50-foot and 100-foot levels about 50 feet long. Ground above 50-foot level stoped 300 feet west of shaft. Open cut on lode 200 feet long. All work in mica schist. Strike in vein north 35° west, 125 feet cross-lode shaft on same vein, about 600 feet northwest of shaft mentioned, 50-foot drift at 50-foot level. Open cut 15 feet deep on surface east of shaft.

Bay View. Tunnel 50 feet on vein. Open cut 75 feet long above tunnel. All in schist. This is a continuation of Eureka vein to the northwest.

Treasury. Tunnel No. 1, 300 feet on vein. Air shaft 125 feet, connecting with tunnel. Tunnel No. 2, 75 feet lower 40 feet long. Hanging wall schist. Footwall granite. This vein is parallel to Eureka vein and distant 300 feet. Between Eureka and Treasury are two other veins on which some work has been done. Tunnel No. 3, 200 feet.

Spring. Shaft 200 feet. Drifts on 60-foot level, 80 feet; on 100-foot level, 150 feet; on 200-foot level, 50 feet. All in schist. Shaft house 20 by 40. Twenty-five horsepower gasoline hoisting engine, blower and pump.

South End. Tunnel 25 feet. Crosscut. Eureka and Treasury veins run through this claim.

Oxide. In schist. Tunnel 250 feet on vein. Air shaft 50 feet. Winze 150 feet, on 100-foot level drift 150 feet. Thirteen horsepower gasoline hoist in tunnel. This claim lies on the east side of the schist belt which is about 1 mile wide.

Telluride. Only surface work and 25-foot tunnel on quartzite. This claim is contiguous to the Mill Site on the east. These veins are in the schist belt which continues southeast several miles.

Mill Site. Crosscut tunnel 40 feet. Shaft 25 feet in quartzite which carries values. The mill is on this claim and also the living quarters. The former consisting of grizzly, ore-bin, Blake rock breaker, self-feed. Five stamp mill, 650-pound stamps, discharging into one 7-foot Lane slow-speed mill, which discharges over 10-foot plates upon two 6-foot Frue vanners. From four to eight months of the year, the mill is run by water power generated by a Knight 40-inch water wheel under 200-foot head. For the dry season there is a 22 horsepower Foos gasoline engine to furnish power. The equipment also includes 10-kilowatt dynamo for lighting mill and house; blacksmith shop with tools; 3,500 lineal feet flumes, 14″x11″; 700 feet 8 inch pipe connecting flume with wheel. Assaying outfit. Five houses and barn.

DESCANSO.

Gold occurs at 300 yards west of this village where Dr. A. J. McDougall controls a number of claims including the Magdalena. The veins trend east and west in diorite. Development work has been carried to the extent of a 100-foot shaft.

A number of claims and prospects are reached from this place, concerning which little information could be obtained. Among them are the following:

Name	Location	Owner	Address	Reference
Clark Mine	9 miles NE. of Descanso	Clark	Descanso	R. XIII, p. 334.
Happy Jack Iron Mask War Eagle	7 miles NE. of Descanso	G. Collier Robbins, deceased		R. XIII, p. 339.
Harper's Mine	12 miles NE. of Descanso. This is within the Cuyamaca Grant	J. D. Harper		R. XIII, p. 339.
Culver El Toro	Quayle Bros. & Cressy		San Diego.	

DULZURA.

R. XI, p. 382; XIII, pp. 335 and 340.

In this district the ore deposits are chiefly in mineralized zones in quartzite and gneiss. The main zone of mineralization is quite extensive, being covered by locations for a distance of 3 miles. It begins in Sec. 8, T. 18 S., R. 2 E., and crosses Sec. 16 diagonally from its northwest corner, bearing about south 39° 30′ east. At some points, in a width of 300 feet there are two or three parallel zones of mineralization. West of the granite, quartzite adjoins a formation of partially metamorphosed black slate and schist. In this, not far from the auriferous zone, is a lens of jasper, which may indicate an equivalence of this slate to the Jurassic, San Luis formation.[1] It may, however, prove to be the Julian formation.

The most extensive holdings are those of Stuart Donohue, comprising the following claims: In Sec. 8, Defiance and New Deal; North Star within Sec. 16, and in Sec. 21 Gold Chief of the Hills, and Golden Artery to the southeast of the preceding. The last two are patented. Beyond them in Sec. 22, along the same mineral zone, are Imperial and Owl.

In Sec. 16, which is School land, are the Johnston and Oneida properties, controlled by Elliott Johnston and others of San Diego. In Sec. 22, east of the Donohue claims and nearly parallel to them are the Pasadena and Banco de Oro claims, controlled by John Fogarty and Charles Burroughs, 553 Fifth street, San Diego.

The owners have been prospecting and developing their claims for some twenty years, but, while much work has been done, no large bodies of rich ore have been found and no substantial production has been attained. The Donohue properties are equipped with a 2-stamp mill.

It seems as if this mineral zone deserves careful study to determine its availability for operation, on a large scale, as a low grade proposition.

Barber Mountain, 4 miles northeast of Dulzura is in Sec. 12, T. 17 S., R. 2 E. There is a property on the southeast side of this mountain, formerly controlled by the Barber Mountain Mining and Milling Company, and now called the Gold Star claim.

The owners are William Hooper and W. E. Kitzman of 846 Fifth street, San Diego. The ore is auriferous chalcopyrite, which occurs in stringers. Development has been conducted by a tunnel 80 to 100 feet long.

MEXICAN BORDER DEPOSITS.

Gold is found at many points near the Mexican boundary, on both sides of the line and in placers as well as in veins. From the placers considerable gold has been taken by hand labor, but none of the veins have yet become producers in a substantial way, though quartz specimens of high grade are often brought in by prospectors.

Near Tecate, Campo and Jacumba, occurrences of this nature have been reported many times during a number of years.

COPPER.

Copper minerals, in limited quantity, are found at several points within this county. One locality called the Defiance District is in the extreme northwestern corner of the county, near the San Mateo Canyon and just north of the Santa Margarita Ranch. It is reached by wagon road from Murietta, Riverside County.

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[1] See San Luis Folio, U. S. Geol. Survey.

All of the claims in this district, mentioned in the Register of Mines and Minerals of San Diego County, have been abandoned. F. McIntosh, of Coronado, was the chief operator.*

This metal has also been found at several points in the hills between Escondido and Encinitas. Some of the claims near Escondido are being kept alive by assessment work, but the old Encinitas Copper mine has not been worked for several years.

This mine is in Sec. 28, T. 13 S., R. 3 W. and is controlled by the Encinitas Copper Company, of which the present representative is W. C. Harland, Spreckels' Theater Building, San Diego. This mine is described in Bull. 50, pages 344–45. There were twenty claims and the vein is 3 feet wide, in porphyry and carries chalcopyrite. There are two shafts and two tunnels on the property. It was proposed to concentrate the ore to prepare it for shipment.

Southwest of Julian the Friday mine, long owned by James Stratton of Julian, is characterized by a considerable extent of iron cap or gossan and shows in its workings copper sulphides and carbonates with small amounts of nickel. This is being developed on a moderate scale. The property which is patented, consists of the north 20 rods of the east 56 rods, SW. ¼ of SW. ¼, Sec. 15, T. 13 S., R. 4 E., and is controlled by the Friday Copper Mining Company, Frank H. Brown, president, American National Bank Building, San Diego; Beecher Stern, secretary, West Coast Gas Engine Company, H and Union streets, San Diego.

The ore body has been opened by a vertical shaft, which is in ore for 60 feet. Below this the vein dips away from the shaft and has been cut by levels at 100 and 130 feet. The upper 60 feet is in the zone of oxidation. At 100 and 130 feet the ore consists of copper sulphides carrying nickel up to 22 per cent.

Assays, Friday Copper Mining Co.

By C. E. Anthony, San Diego, Cal., September 15, 1913.

Gold	.16 ozs. per ton
Silver	1.3 ozs. per ton
Copper	2.4 %
Silica	25.20%
Aluminum and iron	40.24%
Sulphur	5.50%
Arsenic	2.28%
Nickel	22.98%

By C. E. Anthony, San Diego, Cal., December 10, 1913.

Nickel	9.12%

By C. E. Anthony, San Diego, Cal., December 12, 1913.

Nickel	7.78%

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*Since this report was written, W. A. Clark, of Fallbrook, has taken up some claims in the San Mateo Canyon.

By C. A. McAuliffe, Los Angeles, Cal., December 23, 1913.

Nickel	10% (12.8% NiO)
Iron	26% (37.4% FeO)
Gold	$4.90
Copper	Trace
Silver	None
Lead	None

A number of other claims have been located on outcrops near the Friday. Some of these are shown on the Julian map. One of them, the Copper Brick, is owned by Robert Melrose of Julian.

On the San Vicente Grant is a small deposit known as the Barona mine (*see* Bull. 50, p. 345), belonging to L. T. Daley, 1111 C street, San Diego. The vein is in granite and has been explored to a depth of 45 feet. The ore, consisting of copper sulphides and carbonates, carries gold and silver. Chalcopyrite, carrying gold, has been found in small quantities on the east slope of Barber Mountain east of Dulzura. See Gold Star claim under Gold.

From the surface indications, it seems improbable that any one of the deposits, thus far known, has sufficient magnitude to develop into a copper mine of much importance, though some may yield limited quantities of shipping ore.

SILVER.

This precious metal is commercially unknown in San Diego County for the argentiferous lead ores thus far discovered are wholly insignificant. Silver is said to occur in the copper ore at the Barona mine and in that of the Friday mine, near Julian. Further than this silver occurs in small quantities, alloyed with gold, wherever the latter occurs.

In addition to the silver lead ore at Valley Center, a small deposit has been reported from the vicinity of the Noble mines. A. Miller of Descanso at one time worked a claim there.

LEAD.

This metal has been reported in small quantities at several points, the chief occurrence being about 2½ miles north of Valley Center, in the NW. ¼ of Sec. 1, T. 11 S., R. 2 W. Here a formation of mica schist crosses the section obliquely toward the northwest. This schist is quartzose in places and is succeeded on the east by feldspathic quartzite 200 feet thick. Near the north line of the section, in the mica schist, a small outcrop was found, several years ago, containing zinc blende and galena, which, on assay, proved to contain silver. So far as it has been opened, this ore body is small, the vein which dips 60° southwest being about 3 feet wide.

The property is called the Surprise. The chief owner is W. N. Bradbury, who acts as trustee in conjunction with W. H. Baldridge and C. M. Churchill, all of Escondido. The property includes two claims and 80 acres of patented land. The workings consist of a 45-foot shaft and a tunnel 110 feet long with 60 feet of back. Some further exploration was being made at the time of the writer's visit. Lead has also been reported from a point called Metal Mountain on the east side of the Laguna Range and from the vicinity of Deer Park.

ZINC.

This metal is of very sparing occurrence in San Diego County. Besides the Valley Center locality described above, it has been reported from the hills of the San Vicente Grant.

IRON.

R. IX, p. 144.

A few deposits of ferriferous material have been reported in this county but they seem for the most part to be the oxidized capping of veins which, through the oxidation of sulphide ores, have left a formation of gossan at the surface.

The outcrop in Sec. 15, south of Julian is the gossan of the Friday vein, which carries copper and nickel. The 12 to 15-foot vein reported by Goodyear, at corner of Secs. 34 and 35, T. 13 S., R. 2 E. and Secs. 2 and 3, T. 14 S., R. 2 E. and belonging to A. Juch, of Wynola, is said to be of the same character. It is needless to state that such exposures do not represent sufficient tonnage to be of importance as sources of iron ore. They might, however, prove valuable for mineral paint.

MANGANESE.

This metal is nowhere in the county known in commercial quantity. A mile and a half northwest of Jacumba are surface indications of manganese in the form of superficial deposits of the oxide. Some of these may come into use for mineral paint. It has also been reported from the vicinity of Campo.

MOLYBDENUM.

With the advance of civilization, this metal is becoming of increased importance. For a long time its chief use was in the manufacture of ammonium molybdate employed as a chemical reagent in the determination of phosphorus and therefore much used in iron and steel analysis. Sodium molybdate is a blue pigment used in coloring pottery and porcelain, including artificial teeth. Lately it is frequently used with iron in steel alloys for tool steel and for magnets, up to 6 per cent being employed. It is also used in supports for the lower ends of tungsten filaments in electric lamps, and to some extent in electric furnaces.

Ores of this metal have been found at several points in this county. They are reported from the international boundary southeast of Campo and at several points between Campo and Julian. The chief deposit thus far discovered is about 11 miles from Foster and 7 miles northwest of Ramona, on the south edge of the San Pasqual Valley. The ore is chiefly molybdenite, the molybdenum sulphide containing 60 per cent molybdenum, with a small amount of molybdite or molybdenum oxide. It occurs disseminated in flakes and small masses in a micaless granite or aplite which appears to be a dike in the surrounding biotite granite. The prospect work has opened the rock at several points and the molybdenum minerals occur in a zone 30 feet or more in width. Samples of the granite have proved, on assay, to contain 2 to 2½ per cent molybdenum sulphide. Dr. A. S. Eakle determines the dike rock carrying the molybdenite to be a quartz-feldspar mixture without magnesian silicates. A thin section shows orthoclase and quartz predominating, a small amount of albite, microcline and magnetite.

This property belongs to Mrs. E. M. Bour, 918 Harrison ave., San Diego, but is controlled by the Santa Maria Molybdenum Mining and Milling Company, president, E. W. Bour; secretary, E. A. Wagener, 1254 First street, San Diego. Lying in the SW. ¼ of Sec. 3, T. 13 S., R. 1 W., which is covered by agricultural patent, the dike trends southeast, passing into Sec. 10.

TIN.

Some years ago, before Riverside County was formed, San Diego County included the tin mines of Cajalco, but at present no deposit of tin ore is known within its limits that can be regarded as of commercial importance.

Placer miners, working in the mountain gulches, have brought in, from time to time, specimens of black sand containing small grains of Cassiterite or oxide of tin. The principal localities are the gulches on the east slope of the Laguna Mountain. It is also reported from some of the placers in Pine Valley and from the south end of Viejas Mountain east of Alpine, but the latter report lacks confirmation. Another reported discovery is in the Defiance copper district north of the Santa Margarita Grant.

This metal is chiefly used in making tin plate, but also for tin foil and in various alloys such as babbitt, solder, electrotype metal, bronze, etc. The chlorides of tin are used in the silk industry and in dyeing and calico printing.

NICKEL.

This metal, up to 23 per cent, was found by assay in ore from the Friday mine near Julian, which had long been known as a copper prospect.* A small sample shown to the writer had the appearance of Niccolite, a nickel arsenide. No substantial ore body has yet been developed but exploration is now in progress. The association of copper with the nickel involves the use of wet processes in its metallurgy. The chief use of nickel is in making nickel steel which is very tough and resistant to shock. A compound of nickel and iron called invar is used for steel tapes and watch springs, since it varies but little with change of temperature. A very large amount of nickel is used in nickel plating. The metal is also used as a reagent or catalyzer in hydrogenating oil.

Since this area was visited the nickel discovered has attracted much attention. Many new claims have been located and development has been started at several points. A recent discovery of this metal is on the old Gilson property, on the line between the SW. ¼ of Sec. 15 and the SE. ¼ of Sec. 16, T. 13 S., R. 4 E. Rumor mentions an ore body 15 feet wide, averaging 8 per cent nickel at 130 feet depth.

ANTIMONY.

This metal, probably in the form of the sulphide, stibnite, has been reported from several points about the Laguna Mountain, but no definite locality has been announced and the quantity discovered is probably small. Stibnite has also been reported from a point 4 miles west of Jacumba. Antimony is chiefly used in hardening alloys. Its property of expanding in cooling after fusion makes it invaluable in alloys for type metal as it receives sharp edges from the matrix.

BISMUTH.

This metal has been found in small quantities, associated with amblygonite in the lithia vein at Pala. It occurs both as native bismuth and as an oxide. Small samples of native bismuth have been reported from other points, especially near Jacumba. Its uses are in fusible alloys for electric fuses, for protecting boilers, etc., in painting on glass and porcelain and in medicine.

TUNGSTEN.

Trivial specimens of the ores of this metal are said to have been found from time to time, and in the State Museum at San Francisco is a specimen marked Julian, A. J. Burnett; but no deposit has yet been observed which promises to be of any commercial importance. Tungsten is chiefly used in making high grade tool steel, either alone or alloyed with molybdenum and chromium. Its steel alloys have great toughness, and they are used for armor plate and projectiles. It is also used in place of platinum for crucibles and electric furnaces. In the form of fine wire it is extensively used for filaments in incandescent lamps. Sodium tungstate is used as a mordant in dyeing, for weighting silks and for making cloth inflammable.

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*See Friday mine, under Copper, for assays showing nickel.

NON-METALLIC MINERALS.

BUILDING STONE.

With the rapid growth of San Diego as a city and the increasing demand for materials of construction, the use of building stone has rapidly increased and several quarries have been opened in the granites which are so abundant and so easily accessible to transportation. Economy in building, however, is an important factor and the cheaper materials, brick and reinforced concrete, are so generally in use that the more costly granite is chiefly used for monumental and decorative purposes.

No sandstones have been found in the county suitable for building. Near Valley Center is a quartzite which may be fit for quarrying. A few localities of marble are known but have not yet been developed. These are discussed under the proper head.

GRANITE.

Bulletin 38, pages 52-3.

Granite occurs in this county in great variety and abundance, and in excess of all possible future demands. The determining factors in selecting a location for a quarry are first, quality of material and second, convenience for transportation. The larger granite areas throughout California are, consequently, seldom of commercial interest because through altitude or otherwise, they are usually remote from lines of transportation. The quarries of granite opened in San Diego County, as well as those of the other building stones, are, therefore, easy of access.

The following companies and persons are now operating:

Simpson-Pirnie Granite Company, James Simpson, president, Peter C. Pirnie, secretary. Office and works. Two quarries are worked. One is near Santee station on the San Diego, Cuyamaca and Eastern Railway, 25 miles from San Diego in the east side of the hill south of the station. The property comprises 49 acres.

The granite is quarried by hand. The stone is a bright-colored, light gray grano-diorite with a reddish to brownish tint on the weathered outcrop. In some places this discoloration from the oxidation of the iron extends several feet below the surface, while in others it is merely superficial. For the most part the rock is massive and almost free from open seams. It has a remarkably straight fracture, and is easily obtained in rectangular blocks as large as can be handled. There is little stripping and no expensive waste in quarrying. The stone is quite uniform in texture and color, with the exception of a few small blotches caused by local segregation of dark mica flakes. It is largely used for monuments, and for this purpose is cut and dressed at the company's yard in San Diego and shipped in considerable quantities to Los Angeles and other points in southern California. It also makes an excellent building stone, for which it is used to some extent. The annual product amounts to 5,000 cubic feet of dimension stone, 200,000 of paving blocks and 1,500 tons of riprap.

A second quarry of light gray fine-grained granite, controlled by this company, is about 1½ miles west of Foster, in the E. ½ of SE. ¼, Sec. 35, T. 14 S., R. 1 W. The product is used for monuments and paving blocks, the annual output being about 3,000 cubic feet of dimension stone and 100,000 paving blocks.

Andrew Lehnberg, of Foster, operates a quarry on El Cajon Grant, west of Foster, and about 600 yards south of the Simpson-Pirnie quarry. This is also a biotite granite. He also operates a quarry of dark green rock near Lakeside, which Dr. A. S. Eakle has identified as a diorite. This material is derived from boulders, no ledge having yet been opened.

The old Waterman quarry lies 1¼ miles northeast of Foster, near the road to Ramona, in E. ½ of SW. ¼ of Sec. 30, T. 14 S., R. 1 E. It is now owned by Mrs. Emma Cartwright, of Foster, and worked by James and John Grant, of the same place. The rock is a biotite granite, and was used for the Government buildings at Fort Rosecrans.

The old quarry east of the station, owned by Joseph Foster, of Foster and San Diego, is now idle. Until recently, it was leased by the Pacific Electric Railroad Company which quarried paving blocks there.

Charles G. Moore, 2336 Superba street, San Diego. This quarry, which has been in operation about five years, is east of La Mesa, in the east 370 feet of the S. ½ of the SE. ¼ of the SW. ¼ of the SE. ¼ of Sec. 17, T. 16 S., R. 1 W. This stone, which is a diorite, is wholly used for monumental purposes and about 8 carloads of 200 cubic feet are consumed annually.

San Diego Granite Works, corner Eleventh and M streets, San Diego, Fred Fickas, proprietor. Formerly operated a quarry near Mt. Helix, one quarter mile east of Hotel Grossmont. Also at one time operated the quarry near La Mesa, now controlled by Charles G. Moore. It now uses stone from the Simpson-Pirnie quarry west of Foster and from Lehnberg's quarry near Lakeside.

South of Grossmont station is a small quarry on land owned by E. Fletcher, of San Diego, and operated by the Pacific Electric Railway Company for paving blocks. The rock is a hornblende, biotite granite and cleaves into rectangular blocks of great regularity.

Dr. A. S. Eakle's determination of these rocks is as follows:

Pirnie-Simpson, Santee. Granodiorite. A thin section shows much triclinic feldspar as well as orthoclase, a small amount of quartz, biotite and hornblende.

Pirnie-Simpson, Foster. Light gray fine grained granite. A thin section shows much hornblende and orthoclase, little biotite and plagioclase. Some magnetite. The orthoclase is somewhat kaolinized.

Lehnberg, Foster. Biotite-granite. Light gray granite. A thin section shows much quartz and orthoclase, a small amount of plagioclase and brown biotite. Grains of magnetite occur.

Lehnberg, Lakeside. Hornblende-diorite. A thin section shows plagioclase predominating and scattered plates of hornblende. A few rods of biotite occur. The rock has a sprinkling of magnetite with an occasional grain of pyrite.

Waterman, Foster. Granite. A thin section shows quartz, orthoclase, a little plagioclase, some biotite in stringers, very small hornblende, chlorite and magnetite. The orthoclase is slightly kaolinized.

Moore, La Mesa. Diorite. A thin section shows plagioclase predominating, a little orthoclase, biotite and hornblende in about equal amounts, some apatite needles and magnetite grains. An occasional augite crystal occurs.

Pacific Electric Railway Company. Grossmont. Light gray hornblende-biotite-granite. A thin section shows much plagioclase and orthoclase, large plates of biotite and hornblende and some magnetite.

LIMESTONE AND MARBLE.

Limestone, which mainly consists of carbonate of lime, is used for building and ornamental purposes, but chiefly in the metamorphic or crystalline form, which is known as marble.

In San Diego County crystalline limestone occurs at many points, in the areas of metamorphic rocks, but owing to lack of transportation in the regions where it occurs, little attention has hitherto been given to this material.

Near Deer Park, in Sec. 1, T. 15 S., R. 4 E., are two claims, located on white marble, known as North Glacier and South Glacier, controlled by C. P. Hayes, Wm. A. Berkey and Zoe Beyers Vernon. This interest is represented by G. T. Vernon, 523 Timken Building, San Diego, and J. G. Beyers, of Descanso. It is at present intended to undertake the manufacture of lime, bringing the product to San Diego by motor truck.

About 4½ miles northwest of Borrego Springs, Secs. 2 and 3, T. 11 S.,

R. 7 E., is an outcrop of limestone on which claims have been located by Dr. D. B. Northrup, 771 Twenty-second street, San Diego, and T. A. Eckert.

Very extensive deposits of marble, of several shades of color, which will soon be made accessible by the San Diego and Arizona Railroad, are in Coyote Mountain, T. 15 S., R. 10 E., a few miles east of the San Diego County line. These will be described under Imperial County.

About 4½ miles northeast of Dos Cabezas Springs, Sec. 21, T. 16 S., R. 8 E., are two claims covering a deposit containing two colors of marble, and belonging to the Golden State Mining and Marble Company, C. A. Walker, president, Watts Building, San Diego. One stratum, extending about 600 feet in length and 20 feet in width, is pure white, interspersed with tiny black dots. This marble is of high grade, fine grained, slightly harder than common marble and takes a high polish. Adjoining this stratum is one of light gray blue over 600 feet in length and about 180 feet in width. This is of the same quality as the white and black dotted, and is well suited for interior decoration, as in corridors and panels. This deposit lies about 1 mile from the San Diego and Arizona Railroad, but must await the completion of that line.

Near Jacumba, Sec. 2, T. 18 S., R. 8 E., is a dark gray marble on which some claims were located by Mr. L. A. Blockman, of San Diego.

MEXICAN ONYX OR ONYX MARBLE.

This handsome ornamental stone is mineralogically aragonite, a form of carbonate of lime often deposited from hot springs. The only occurrence in this county has been reported from the valley of Los Peñasquitos Creek on the grant of that name.* The exact locality could not be ascertained by the writer.

JASPER.

A deposit of red and white banded jasper occurs southeast of Dulzura, east of the Donahue gold mining claims. Dr. C. C. Vallé, of San Diego, is the owner of the property. This material is handsome and may become valuable for ornamental purposes, but it has not yet been offered on the market.

ORBICULAR GABBRO.

Bull. 38, p. 56.

About 6 miles east of El Cajon on the north bank of the Sweetwater River, and about 1 mile west of Dehesa, in Section 14, T. 16 S., R. 1 E., is a large mass of gabbro, portions of which have an orbicular structure and show a highly ornamental surface when polished.

This gabbro is intrusive in the midst of the granite. It outcrops over an area of about a square mile on the hill near Dehesa and extends 3 or

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*Bulletin 38, page 369.

4 miles southeast. The hill on which it occurs rises about 1,800 feet above sea level. On the slopes, in the central portion of the gabbro mass, the orbicular rock occurs in scattered boulders, which vary in size, some of the larger ones being several feet in diameter. It has not, however, been found in place.

There are three varieties of this orbicular rock, based on variations in its texture. In the most common variety, an outer ring of feldspar surrounds a nucleus consisting of a crystalline aggregate, much like the ground mass of the rock. Another variety consists of spheroidal bodies showing neither concentric nor radial structure. These appear to be harder and of firmer texture than the surrounding material and, on the disintegration of the rock by weathering, rounded balls remain like pebbles in the residuum. The third variety has both radial and concentric structure.

The rock consists of the plagioclase feldspar, anorthite, hornblende, hypersthene and iron oxide. It varies considerably in texture outside of the spheroids, some portions of the mass being rather finely crystalline and others quite coarsely crystalline. Some of the hornblende crystals, in place along joint planes, are several inches in length. The basic character of the orbicular portions is shown by the analysis of an orbule.

Analysis of an Orbule of the Gabbro by Jas. W. Howson.[1]

	I	II
Silica (SiO_2)	40.50	39.76
Alumina (Al_2O_3)	23.01	22.71
Iron oxide (FeO)	11.96	11.96
Magnesia (MgO)	12.24	12.56
Lime (CaO)	11.44	11.39
Soda (Na_2O)	1.19	1.33
Potash (K_2O)	.40	.37

Analysis of the Feldspar of the Gabbro by W. T. Schaller.[2]

Silica (SiO_2)	-----------	44.39
Alumina (Al_2O_3)	-----------	36.55
Lime (CaO)	18.67	-----------
Soda (Na_2O)	.83	-----------

This analysis indicates anorthite or lime feldspar.

This orbicular gabbro is adapted to interior decoration, because of its variegated texture and color. Without being gaudy or bizarre, it has a rich coloring and a unique configuration that should catch and please the eye.

No definite estimate can be made of the quantity of this stone now available. It is seen only in boulders, and these form but a small percentage of the boulders on the hillside. Their occurrence is such as to leave one in doubt as to whether they came from a single dike-like portion of the mass, or from several separated portions. The number and size of the boulders scattered over the surface indicate that there is considerable stone here available for commercial purposes, and exploration may reveal the rock in place. If it should be found in sufficient quantity to furnish a constant supply to the market, and to fill orders in a reasonable time, it ought to readily find a place among ornamental stones. Since it is almost unknown as a commercial product, architects would be slow to specify it until assured that it is obtainable in quantity.

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[1] Univ. of Cal. Dept. of Geol. Bull. No. 17, Vol. III, p. 394.
[2] Bull. 38, p. 59.

This gabbro area was first mentioned by Fairbanks, R. XI, p. 85. The orbicular rock was first discovered by Marion Powers , of Dehesa. Professor A. C. Lawson, of the University of California, gave a short description of it in ''Science,'' Vol. XV, page 415, and a more extended one in Bull. No. 17, Vol. III, Dept. of Geol., Univ. of Cal. W. H. Kessler and W. R. Hamilton, of Stanford University, made a study of this rock and published an excellent illustrated description of it in the American Geologist for September, 1904. See Bull. Nos. 37 and 38, State Mining Bureau.

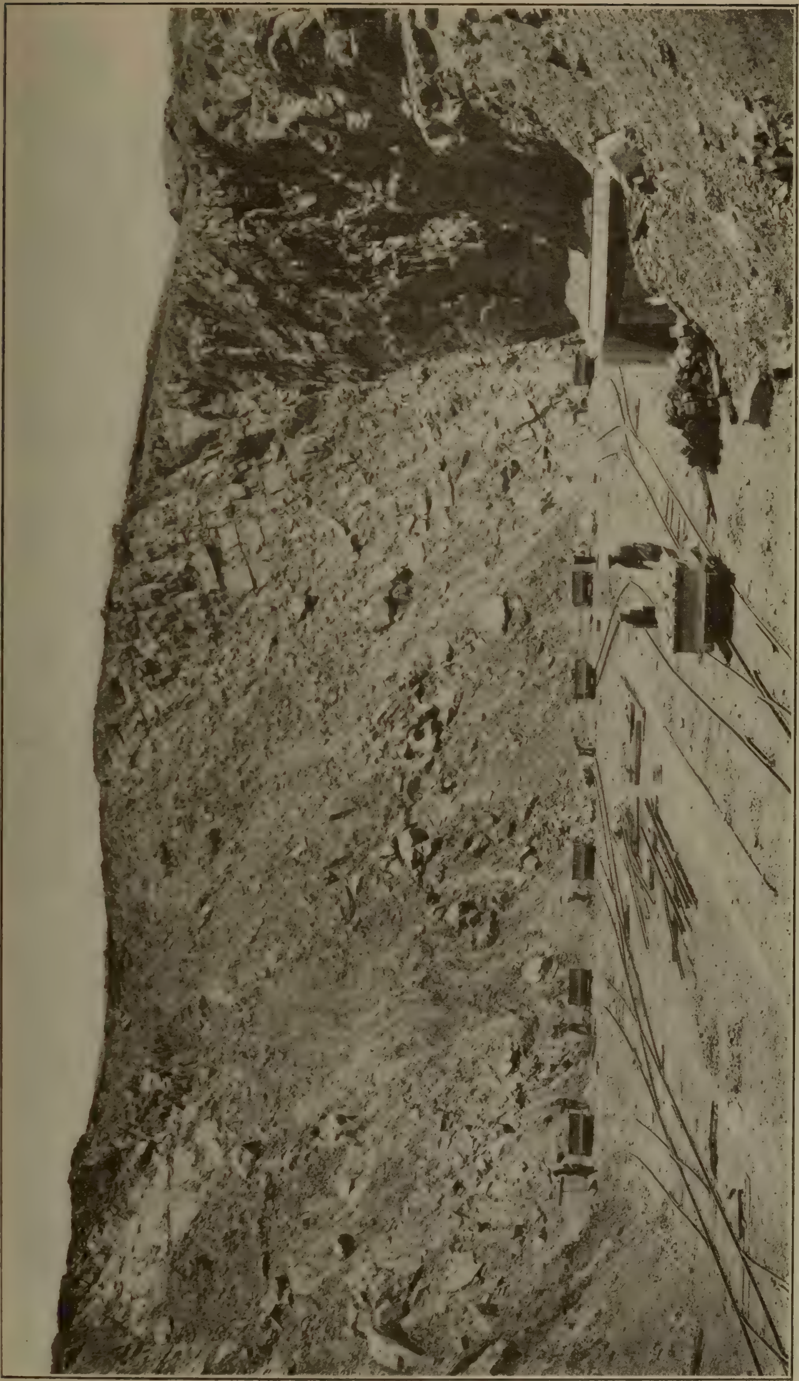
The deposit is controlled by N. Kessler and Marion Powers, of Dehesa.

CRUSHED STONE AND SAND.

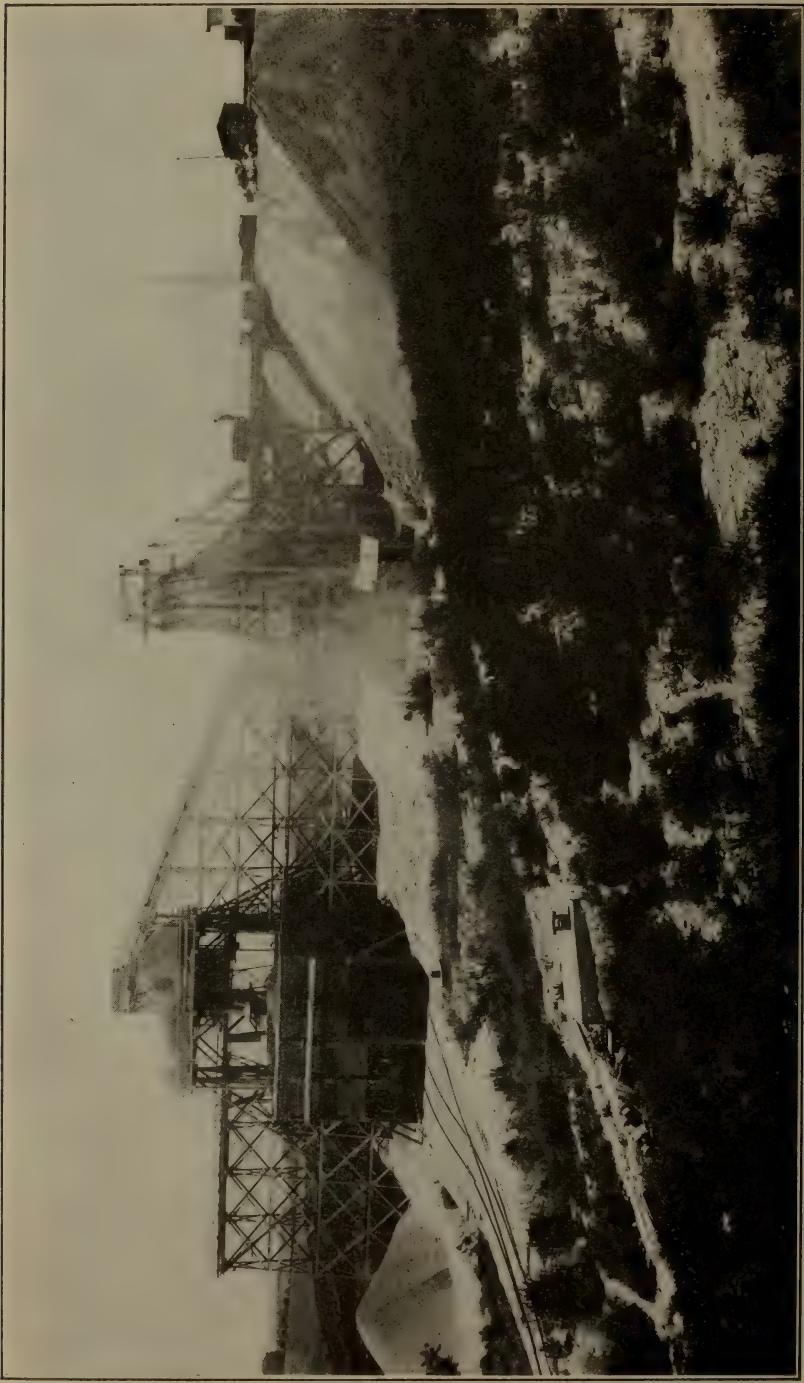
The large demand for crushed stone and sand for concrete and their ever-increasing consumption make these materials of great importance to a municipality.

San Diego is especially favored in the extensive area of intrusive felsite which is now quarried at Spring Valley and Sweetwater Dam, and, if necessary, could be quarried at other points. The gravel from the Otay River Valley and from Rose Canyon as well as from other areas around the Mesa is almost entirely of felsite or some other volcanic rock of similar qualities.

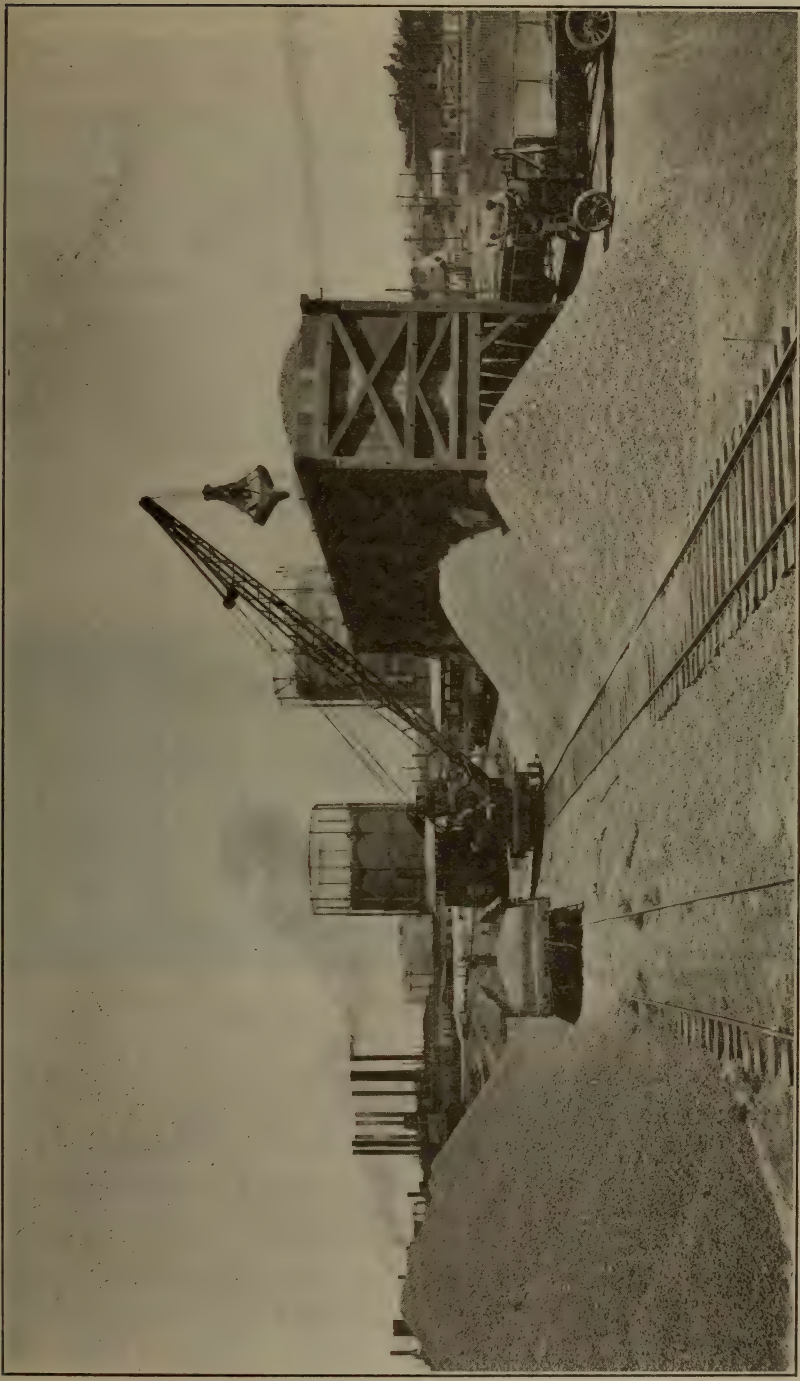
Independent Stone Company, 713 American National Bank Building, Geo. L. Parker, president, L. J. Rice, secretary. This company produces crushed stone for concrete and sand for the same purpose and for general building operations. The stone quarry is southwest of Spring Valley station on the west side of the track. The crushing plant is on the east side of the railroad at the same point. The rock is a fine grained felsite which forms a hill immediately north of Lemon Grove, rising some 300 feet above the mesa level. The production of crushed stone is 75,000 tons per year.



Quarry of the Independent Stone Co. Near Spring Valley.



Crushing Plant of the Independent Stone Co. Near Spring Valley.



Filling Storage Bins. Independent Stone Co.

Building sand washed from the neighboring granite areas is shipped by this company from the river bed one half mile south of Foster and 300 feet west of the railroad track. The sand is loaded into cars by a Brown hoist of 15 tons capacity, using a 5½-foot bucket. At the delivery station, at Thirteenth and Newton streets, San Diego, the cars are unloaded and the sand transferred to storage bins by a Bay City Industrial Crane, using a 1-yard bucket. Production 40,000 tons per year.

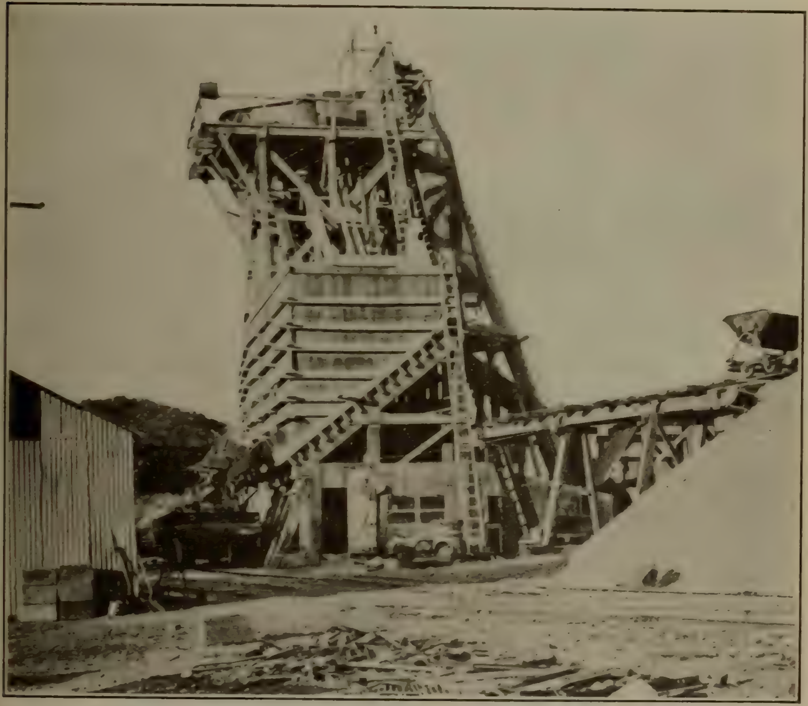
San Diego Stone Company, 643 Spreckels Building. President and manager, E. A. Hornbeck; secretary, C. Kalbough. This company produces crushed stone for concrete. The quarry opened in 1887 for Sweetwater Dam, is west of the dam on the south side of valley. The property consists of 15 acres held in fee, a portion of the Rancho La Nacion. Gates and Simons Disc crushers are operated by electric power. Daily capacity of plant 400 tons. The annual production of crushed stone is about 49,000 tons. Of riprap and jetty stone 21,000 tons.

Sweetwater Quarry, San Diego Stone Co. Sweetwater Dam and Mt. St. Miguel. F.J.H.M. Photo.

Fenton-Sumption-Barnes Company, 168 Tenth street. H. G. Fenton, president; H. W. Sumption, secretary. This company produces gravel and sand from the valley of the Otay river and sand from the Tia Juana Valley. The sand consists of two grades; coarse for concrete and fine for mortar. The gravel is produced in two sizes; one inch and inch and a half. Crushed stone is also produced from cobbles and sold in one inch size. About half of the sand comes from the gravel washing plant in the Otay River Valley. Here the company controls 160 acres along the stream bed in Secs. 22 and 23, the plant being in NW. ¼ of the SW. ¼ of Sec. 22. The company also works a deposit of sand in the

SE. of Sec. 1, near Tia Juana. Other sand tracts are controlled near Riverview and Lakeside, each about three quarters of a mile long and comprising 100 acres. The sand here is loaded with a locomotive crane and sold in its natural state. The plant began operations in June, 1912, and from that time until May, 1913, were shipped 5,859 cars of 25 tons each, two thirds of these being of crushed stone and one third sand. From the plant at Otay shipments amount to 350 cars per month.

The Sylvan Gravel Company, J. P. Stibolt, president and manager, J. Brown, secretary.



Crushing and Screening Plant. Sweetwater Quarry, San Diego Stone Co.
F.J.H.M. Photo.

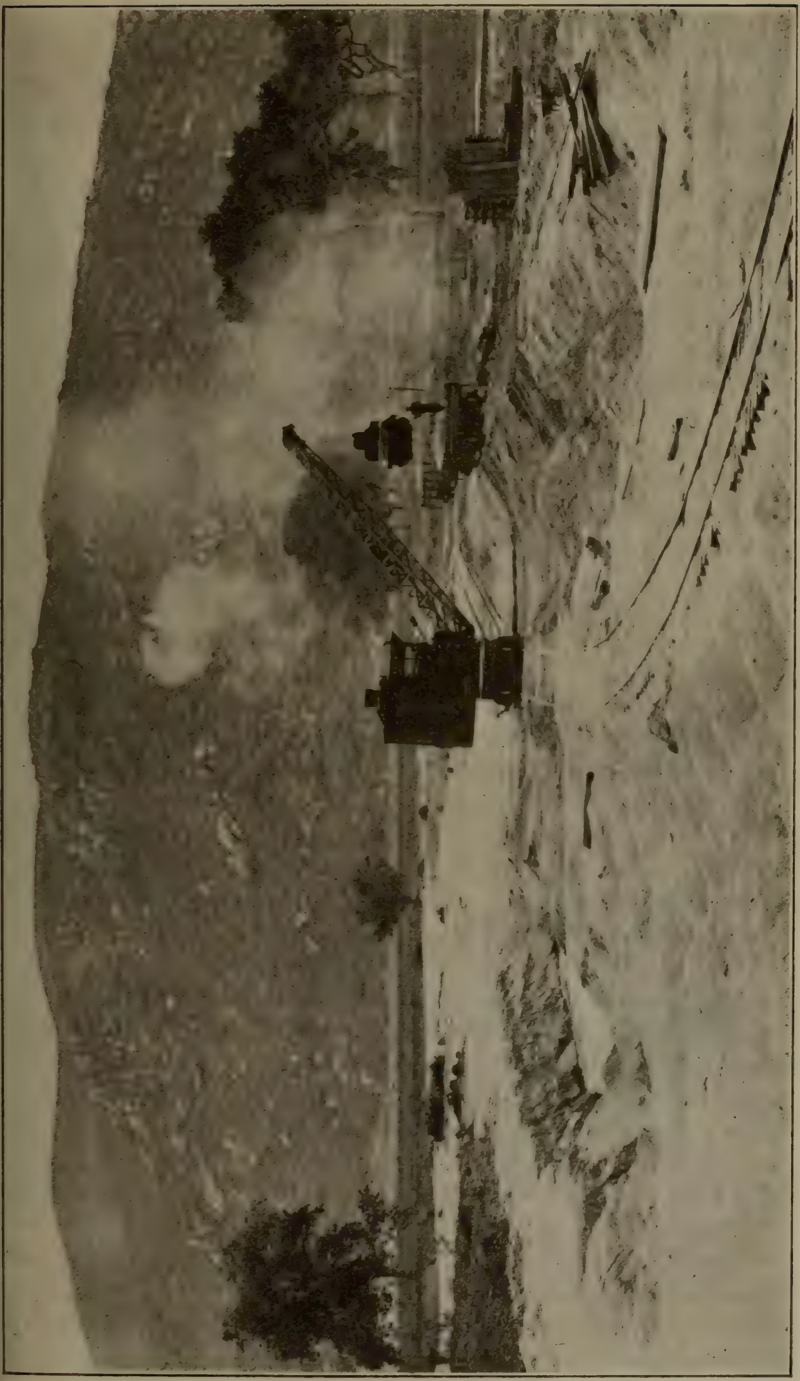
This company operates a plant in Rose Canyon near Selwyn station, using gravel and cobble stones from the arroyo bottom. A small crushing plant is in operation. The city office is at the southwest corner of Eighth and M streets.

The Mission Rock Company, 111 C street, L. T. Daley, president; Geo. W. Pierce, secretary.

This company operates a plant in Murphy's Canyon, north of the Mission Valley. The chief product is crushed cobble stones. Having been in operation only since August, 1913, it has not yet attained much production. Its capacity is 50 tons per day, using a No. 3 Austin gyratory crusher. A washing plant is now being installed.

In the Mission Valley several other companies have gathered sand for building and marketed it in San Diego. In the northern part of the City, east of the State Normal School, a small portable plant is operated by Ole Nelson for crushing cobble stones for concrete.

Sand and Gravel Washing Plant. Fenton-Sumption-Barnes Co.
Otay River Valley. F.J.H.M. Photo



Loading River Sand near Foster. Independent Stone Co.

LIME.

Lime (CaO) is the oxide of the metal calcium and, in some form is the basis of all mortars and cements used for building. When comparatively pure it is common lime, or quicklime. When mixed with a small percentage of clay or silica it forms poor or meager limes, with the increase of clay it forms hydraulic lime, and when mixed with clay in proper proportions and properly burned and ground it forms Portland cement. Lime combined with sulphuric acid forms calcium sulphate, which occurs in nature as gypsum and makes plaster of paris.

The numerous beet sugar factories in this state use large quantities of lime, several quarries being operated for these factories alone. The manufacture of beet sugar being liable to increase in the near future, an increased demand for lime for this purpose can be expected. The remainder of the product is used for furnace flux, as a fertilizer, for mortar and plaster in building operations, in glass manufacture, and other minor industries.

Lime is produced commercially, by heating limestone in furnaces known as limekilns. Limestone consists of calcium carbonate, which, when sufficiently heated loses its carbon dioxide, which escapes as a gas, and the quicklime remains. Limestone begins to lose carbon dioxide at about 750° F., but requires a temperature of over 1300° F. before it is driven off. In chemically pure carbonate, there are 56 per cent of lime and 44 per cent of carbon dioxide, but there are also nearly always present, some moisture and organic matter, which are driven off, and varying percentages of clay, magnesia, iron oxide, etc., which are not driven off, in the burning. So the resulting lime may vary from 56 per cent to 30 per cent or less of the stone. Moisture in the stone facilitates the burning, so that a freshly quarried, moist stone is more readily reduced than a dry one. Hence a dense, compact stone is reduced with greater difficulty than a porous one, but the quality of lime is better.

Lime and cement, as materials of construction, are so important in the development of a city like San Diego, that there is little doubt that in the near future, lime will be burned within the county and that the necessary association of lime and clay will be found at some point conveniently situated for the establishment of a factory for Portland cement. In 1890 a beginning was made with a calcareous deposit on the Jamul grant by the erection of a cement factory.[1] It was found, however, that at that time, it could not be made and delivered in San Diego in competition with European Portland cement brought by water freight. This deposit, with the whole of the Jamul Grant, belongs to J. D. Spreckels and has been carefully experted for him, but not found of sufficient promise to justify further operations. As railroads are built through the country and, with the perfection of the automobile truck, means will be found to make these valuable materials and bring them to market at reasonable prices.

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[1] R. IX, pp. 139 and 309–11; XI, p. 383.

Calcareous materials are not especially abundant in the western part of the county, for the Tertiary deposits conceal palæozoic and mesozoic strata which may be calcareous. We must, therefore, look chiefly to the country east of the mesas where, in the metamorphic formations, are numerous limestone outcrops. One of these is near Deer Park east of the Cuyamaca Grant,[2] another is in the area east of Warner's ranch. On the road to Oak Grove there is said to be an old limekiln near Deadman's Hole. On the eastern slope of the divide, in the region of Jacumba and northward from that point, an abundance of limestone is reported. An outcrop of this material occurs 4½ miles northwest of Borrego Springs. Some of these deposits will be made accessible by the San Diego and Arizona Railway, now under construction.

In the mesa itself, near Otay, is a calcareous layer not far below the surface. A similar deposit occurs near Lemon Grove, but these are of insufficient thickness, so far as known, to be of commercial interest.

BRICK CLAY.

At the outset, surface clays were generally used in San Diego for the manufacture of brick, but it has been discovered that, in the bluffs of Rose Canyon, about 10 miles north of the city, are extensive exposures of Eocene Tertiary clay or shale, extending for a distance of some 3 miles north from Ladrillo on the Atchison, Topeka and Santa Fe Railway, and well adapted for making brick and building tile and easy of access through their nearness to the railroad. Consequently, now, all the brick companies are using this shale in their manufactures and all but one have located their plants in this canyon. At some points, certain layers of this shale exhibit the property of vitrifaction, but no vitrified brick is yet being manufactured.

While as yet out of reach, in regard to transportation, attention must be drawn to the great areas of Miocene Tertiary clays which occur on the eastern margin of the county, where the deposits of the Salton Basin lie in the re-entrant bays of the granite ranges. (See geologic map.) The extent of these is very great, amounting to several hundred square miles, but little is known of their properties.

BRICK.

San Diego Brick Manufacturers.

Bulletin 38, page 254.

The following companies and individuals are now engaged in the manufacture of brick and building tile:

F. L. Hieatt Brick Co., F. L. Hieatt, president; J. R. Jolly, secretary. Plant, corner California and Juniper streets. Now using Tertiary clay from Ladrillo in Rose Canyon. The plant consists of 1 dry press, 18,000 daily capacity, and 1 stiff mud machine, 60,000 daily capacity. Electric power is used and about 20 men are employed. Oil is used to heat the kilns.

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[2] See Marble.

Union Brick Co., corner Twenty-third and Pierce streets. This company, formerly in San Diego, has recently moved its plant to Rose Canyon.

R. M. Hubbard, 548 Spreckels Theater Building. This plant is in Rose Canyon near Ladrillo in Pueblo Lot 1787. The equipment is a Penfield stock machine using electric power; 20 to 25 men are employed. These kilns are heated with crude oil.

Rose Canyon Brick Co. Plant near Ladrillo. J. S. Akerman, 1311 E. First street. This plant is now idle.

San Diego Vitrified Brick and Clay Products Co., president, C. E. Anthony; secretary, C. H. Anthony. Office, 858 Fourth street. This company controls 100 acres of Tertiary clay on Rose Canyon, in Pueblo Lot 1267. The equipment is one dry press of 20,000 capacity, operated by electric power. The company claims superior vitrifying properties for the clay which it controls and proposes to manufacture paving brick and other similar products.

Sunnyside Brick and Tile Co. This company is also in Rose Canyon, west of the preceding.

In addition to the brick made in San Diego, a large quantity is shipped in from Los Angeles.

POTTERY MATERIALS.

Bulletin 38, page 227.

Pottery clay, kaolin, feldspar and quartz have long been known in San Diego County, but, until recently, no one had invested the capital necessary to carefully investigate and utilize them. This work has recently been undertaken by the California China Products Company, Walter Nordhoff, president, C. H. Nordhoff, secretary, which has erected a plant on Twelfth street, National City. This comprises all necessary clay working machinery together with two 18-foot and one 14-foot down-draft kilns. Oil is used as fuel, and electricity for power. About 25 men are employed.

This company was founded to make fine china of the French type, and the proper clays for this purpose were found and located or bought. But on investigation of the labor question it was found to be impossible to make such china commercially in California. A change of plan was therefore made, and, using some of the same materials and others afterward located or bought, the manufacture of glazed Faience tile was begun. This proved so successful that, in addition to mantel and hearth Faience, the extended use of the glazed tile has become common in wainscots and in both interior and exterior floors, whether exposed to sun and rain or protected or partially protected. Its use has been specified for the exterior of the great dome of the California State Building at the San Diego Exposition, and also for floors and wainscots in the New York State Building at the San Francisco Exposition. It has also been used in the better class of stores and club buildings throughout the coast, and is being shipped to New York and successfully sold there in competition with the best American and imported tile. In addition to this Faience tile, experiments have been finished and clay deposits located or bought, which will enable this company to produce in future as they desire, sanitary ware of first rate quality, high tension electric insulators, yellow mixing bowls, and quarry or mission blocks for flooring.

Owing to the labor cost, the company does not propose to manufacture china in any form, but the products specified above will be gradually introduced. The yellow mixing bowls are about ready to go on the market. Only California clays and California labor are used in the manufacture of these products.

The raw materials investigated by this company are from various sources. The larger part of the clay used is from Aberhill, Riverside County. From San Diego County they have experimented with the following:

Kaolin, from the west peak of Cajon Mountain. This has long been known and was mentioned in Bulletin 38, page 227. Besides this locality it has been reported from San Vicente Mountain, Poway and Lyons Peak.

Feldspar, from Sec. 27, T. 16 S., R. 1 E. This is southwest of Dehesa.

Quartz, was obtained from a deposit southeast of El Cajon Mountain.

Yellow burning non-plastic clay, almost fire clay, was obtained near La Costa station. This clay is on the Huchting Ranch and lies in the NE. ¼ of Sec. 25, T. 13 S., R. 4 W.

The use of these materials is still in the experimental stage and no detailed information is available concerning their qualities. Since the writer's visit he is informed that their use has been discontinued.

A deposit of white clay, fit for fire brick, lies on the Kelly Estate, near Farr Station, 7 miles south of Oceanside. This is leased by the F. L. Hieatt Brick Company of San Diego.

No doubt many other deposits will be found in San Diego County, since the great granite ranges must have yielded, by their decay, vast amounts of feldspathic material, but only exhaustive tests by manufacturing interests will definitely determine their value. Mere chemical analysis is suggestive but not final.

Near the plant of the California China Products Company, on Twelfth street, National City, is the workshop of the Markham potteries. This is a new industry recently established by H. C. and K. S. Markham, formerly of Ann Arbor, Michigan, who are preparing to make art pottery of various types, using the Nordhoff kilns for the final execution of the work. It is hoped that this enterprise will prove entirely successful.

GLASS SAND.

Near Boulevard and about one half mile from the surveyed line of the San Diego and Arizona Railroad are three deposits of pure white quartz. They are reported to be free from iron and other impurities and would therefore be adapted to the manufacture of plate glass, porcelain, fluxes and for many uses in the arts. High grade silica is scarce in this region and these deposits appear to be of the best grade.

SAPONITE.

Three miles southeast of Otay there is a deposit of this mineral, a massive, clay-like variety of kaolin, containing a great amount of combined water. It is locally known as ''mineral soap'' and was mentioned by W. A. Goodyear as montmorillonite, R. IX, p. 139. It forms a layer from 2 to 5 feet thick a few feet below the surface of the mesa and underlying several hundred acres. Outcrops have been seen at several points in the bluffs of the Otay River Valley. No commercial use has yet been found for this material.

GYPSUM.

The principal deposits of this material are just over the line in Imperial county and will be described under that head. Small deposits are reported in San Diego County, just west of those above referred to and the Carrizo Creek clays contain plates of selenite, the transparent form of this mineral.

ASBESTOS.

Bulletin 38, page 263.

Two distinct minerals are known in the market as asbestos. One is a form of actinolite, or of tremolite, which are varieties of hornblende, a silicate of lime, magnesia and iron, and has fine, soft, flexible fibers like cotton. Most of the commercial asbestos, however, is a variety of serpentine, called chrysotile or amianthus, a hydrous silicate of magnesia, containing about 14 per cent of water. Though, in many respects, both varieties possess similar physical properties, and the heat-resisting qualities of both varieties are about equal, the chrysotile variety is superior to amphibole asbestos in strength and elasticity. Consequently, for all purposes in which non-conductivity of heat is the important factor and not strength of fiber, as in fireproof paint, wall plaster, boiler and steam pipe covering, fireproof packing of safes, etc., both varieties can be used. Infusorial earth, talc and mica are strong competitors of asbestos in these lines.

In the manufacture of cloth, rope, felt boards, tubes, washers, and blocks of various shapes, strength of fiber is essential, as well as nonconductivity, and only the chrysotile variety can be used. The fibers of chrysotile are usually from one half to 1½ inches in length, and seldom exceed 2½ inches.

Mill fiber, a paper stock, is made of minute fibers of asbestos which have become broken and are not available for weaving. Asbestic is the final waste material, which contains a small amount of minute fibers and a considerable amount of crushed serpentine rock.

In San Diego County, small deposits of good fiber are reported in the mountains three miles east of Warner's Hot Springs. See R. IX, p. 148. No doubt, in time, other deposits will be discovered.

MICA.

This name includes several species, the most important commercially being muscovite and biotite, which are silicates of alumina, with potash, magnesia and iron. Cleaving in thin, transparent plates and resisting heat, muscovite is used for stove doors. For its non-conductivity of electricity, it is used as an insulator in electrical appliances. Pulverized, it is used to give a brilliant surface to wall paper. Biotite, lacking transparency, is chiefly used ground fine as an insulator against heat in fireproof safes. This material is not abundant in San Diego County, but some good sized plates of light colored biotite have been brought from a prospect near Jacumba. This information is furnished by Mr. W. H. Trenchard, of San Diego.

MINERAL PAINT.

For exterior work oxides of iron and manganese are extensively used as well as various colored earths or ochers, which owe their shades of red, brown and yellow to the metallic oxides present. Such materials can be found at several points in this county but thus far no use has been made of them.

The principal deposit which now merits attention as a source of paint is about 8 miles southwest of Escondido and about the same distance from Encinitas in the south half of Sec. 3, T. 13 S., R. 3 W. Here is a bedded deposit of the mineral pinite, usually referred to as palagonite. This, however, is probably an error of spelling for *paragonite,* since palagonite is a deposit of volcanic glass. Claims known as White Hawk, Ocean View and Pinite Queen were located here prior to 1902, and after several experiments in utilizing the material commercially and some financial mishaps the locations passed successively through the Palagonite Industrial Mining Company and the Premier

Investment Company, both of San Francisco, and now are held by the Pacific Paint Products Company, I. P. Janssen, president, J. E. Neal, secretary, 709 Central Building, Los Angeles. This corporation is about to build a factory near the Santa Fe Railway tracks, between Fifty-fourth and Fifty-fifth streets, Los Angeles. Through the courtesy of Mr. Janssen, I am able to quote from the report of a careful examination of the properties by Smith, Emery & Company, of San Francisco.

The deposit is traceable for a distance of some 4,000 feet, its streak being nearly east and west and its dip 45° north. It varies from 70 to 100 feet in width and is underlain by diorite, which forms the foot wall, while the hanging wall is of basalt. Near the foot wall the color is reddish and yellowish, while toward the hanging wall it grows lighter in shade, passing through light yellow and gray to white. The portion available commercially is described as averaging 12 to 15 feet in width.

Analyses by Smith, Emery & Company give the following results:

White.

Silica (SiO_2)	67.47%
Alumina (Al_2O_3)	20.33%
Iron oxide (Fe_2O_3)	1.85%
Lime (CaO)	.09%
Magnesia (MgO)	.13%
Loss in ignition	7.82%
Alkalies (by differences)	2.31%
Total	100.00%

Gray.

Silica (SiO_2)	66.58%
Alumina (Al_2O_3)	21.07%
Iron oxide (Fe_2O_3)	1.93%
Lime (CaO)	.12%
Magnesia (MgO)	.10%
Loss in ignition	8.26%
Alkalies (by differences)	1.94%
Total	100.00%

It is stated that the colored portions of the deposit are very suitable for pigment, both for exterior use and for kalsomine. It is further suggested that the material may successfully be used for polishing powder, paper filler, cosmetic, putty, working crayons, and talcum powder. The report also states that it is available for making tips for coal gas and acetylene burners.

With all these possibilities it is to be hoped that the owners will find no further difficulty in making a commercial success. Probably this material was deposited as a volcanic tuff and since the writer has observed white tuffs at other points it may be that similar material will be discovered elsewhere in the county.

East of Warner there is a deposit of ochre which as yet has been but slightly prospected. F. B. Hahn, formerly of 1850 North Main street, Los Angeles, is the owner.

GEMS.

The gem minerals of California have been described at great length in Bulletin 37 of the State Mining Bureau, by Dr. George F. Kunz, of New York City, whose long experience and commanding position in the gem trade of America have given him exceptional opportunities for knowing of the material produced and judging of its quality. In that bulletin is much invaluable, historic and descriptive detail relating to gems mined in San Diego County, which can not here be repeated. Since this most valuable bulletin is still for sale, those wishing minute detail regarding the occurrence and character of the gems are referred to it for more complete information. The purpose of this article is to concisely review the subject and supply all details which have become current since 1905, when Bulletin 37 was issued, together with some facts hitherto omitted. Also, the geology of the deposits more fully discussed and the relation and position of the principal mines are defined more accurately than heretofore, since in Bulletin 37 some of the section numbers are incorrect.

The gem industry of this county has at times attained considerable prominence though at present much depressed. At the time of the writer's visit none of the gem mines were in operation. This is partly due to a decline in the demand for San Diego County gems. For a long time there was an active demand by Chinese merchants for the red tourmaline which is highly prized in their country, and this served as an outlet for the material of medium quality so that the finest specimens of gem quality could be used for local consumption in the tourist trade, or sent to the New York market. With the death of the Dowager Empress of China and the outbreak of the revolution in that country the demand for such luxuries was suspended and at present, there being no market for medium quality tourmalines, it hardly pays to work the mines. Good specimens of kunzite find a ready sale, but the principal source of this material, the Pala Chief mine, has not been recently in operation. The other gems, while very beautiful, are not now in sufficient demand to create an active market.

The list of San Diego County gems and gem minerals is large and interesting and comprises 17 species which may logically be arranged in two groups, (A) those of commercial interest and (B) those not yet commercially important.

(A) GEM MINERALS OF COMMERCIAL INTEREST.

Name	Localities
Topaz	Ramona.
Spinel	Rincon.
Beryl	Pala; Mesa Grande; Ramona; Aguanga Mountain; Jacumba.
Garnet	Ramona; Cajon Mountain; near San Vicente; northeast of Jacumba.
Tourmaline	Pala; Moosa Canyon; Mesa Grande; Aguanga Mountain.
Spodumene (Kunzite)	Pala.

It should be noted that fine specimens of these minerals are in demand for mineralogical collections in museums as well as for gems, and in this way possess commercial interest apart from their value to the lapidary. Further they are not only commercially important, but also in this county they all occur in pegmatite dikes and therefore, in their geologic relations, must be discussed together. For a minute description of the gems found in the San Diego mines the reader is referred to Bulletin 37, for Dr. Kunz having had the opportunity of seeing all the best material, his descriptions are detailed and authoritative. For this report a condensed summary must suffice but in several cases the writer has freely used Dr. Kunz's statements.

Topaz: Bull. 37, pp. 46–47.
Silico-fluoride of alumina.
H. 8; G. 3.4–3.6. Brittle, luster vitreous. Color yellow to brown and pale green to blue, often colorless.

The chief locality in this county is Ramona, where in the Little 3 and Surprise mines were found crystals varying in color from white, light yellow and sea green to sky blue. Some of these were over a pound in weight.

Spinel: Bull. 37, p. 47.
Aluminate of magnesia, often with iron oxide.
H. 8, G. 3.52–4.1.

Color usually various shades of red. At Rincon, in the Mack mine, blue crystals of small size have been found.

Beryl: Bull. 37, pp. 48–50.
Silicate of alumina and glucina.
H. 7, 5–8, G. 2.7.
Luster vitreous. Color green, yellow and white to rose red.

The more familiar forms of this mineral are the rich green gem known as emerald and the sky blue and sea green stone called aquamarine.

In San Diego County rose colored beryls have been found in the Himalaya mine at Mesa Grande and on Aguanga Mountain. The principal specimen from the latter weighs nearly 2 pounds and is in the United States National Museum. Other beryls of pink color have been found in the Katrina Mine at Pala; in the Esmeralda mine at Mesa

Grande, together with golden beryl and aquamarine; both pink and green shades at the Crystal Gem mine, 8 miles northwest of Jacumba, and in the Surprise and A B C mines at Ramona. Golden beryl has been found 1 mile northwest of Jacumba. Other beryls are reported from the Hercules and Lookout mines at Ramona and the Mack mine near Rincon has produced very beautiful aquamarines.

Garnet: Bull. 37. pp. 50–54.

Silicate of alumina, lime, magnesia, iron, manganese, chromium, or titanium.

H. 6.5. G. 3.15–4.3.

According to composition they are mineralogically classed as follows:

Alumina Garnet	Alumina-iron, *Almandite,* cherry red to deep red. Alumina-manganese, *Spessartite,* red brown and orange red. Alumina-lime, *Grossularite,* var. essonite, white, yellow, brown to red Alumina-magnesia, *Pyrope,* blood red to black.
Iron Garnet	Iron-lime, *Andradite,* yellow or orange brown.
Chromium Garnet	Chromium-lime, *Ouvarovite,* emerald green.

By jewelers these stones are classed more by color than by chemical composition. Essonite has been found in limestone at several points 9 to 10 miles northeast of Jacumba, also near San Vicente. The finest crystals have been found at Ramona in the Hercules, Lookout, Surprise and Prospect mines. From some of these, gems have been cut up to 6 and 8 carats weight.

Tourmaline: Bull. 37, pp. 54–63.

Silicate of alumina, magnesia, iron, boron and alkalies (soda, potash, lithia) with small amounts of water and fluorine.

H. 7–7.5. G. 3–3.2.

Brittle, luster vitreous. Colors, black, blue, green, yellow, red, brown, colorless. The red or pink variety, called rubellite, is highly prized by the Chinese.

Gem tourmalines were first found in this county at Mesa Grande about 1895. The rubellite in lepidolite at Pala was first reported in 1890. Mesa Grande has yielded perhaps the largest number of fine crystals. The two-color stones, red and green, are especially fine. Dr. Kunz estimates that $30,000 worth of mineralogical specimens have been obtained here and that the gems aggregate up to 1905, some $200,000. The Pala Chief mine and the Hiriart Mountain claims have also yielded much valuable material.

Spodumene: (var. Kunzite) Bull. 37, pp. 81–93.

Silicate of alumina and lithia, usually with a little sodium.

H. 7–7.5. G. 3.19. Brittle, luster vitreous, on cleavage surfaces pearly. Lamellar structure parallel to vertical axis.

This handsome lilac and pale pink to white spodumene discovered in 1902 and found only at Pala in this county, and at the Fano mine near Coahuila in Riverside County, has become of world-wide interest. The darker stones are especially beautiful but are said to fade slightly after long exposure to light. The Pala Chief and White Queen mines at Pala are the chief sources, but the former has yielded the largest masses. Some very large specimens have been found weighing up to 24 ounces.

THE PEGMATITE DIKES AND THE GEM VEINS.

It has long been known that in San Diego and Riverside counties the principal sources of tourmaline, kunzite and garnet, together with the less abundant beryl, topaz and spinel, are pegmatite dikes of large size and substantial extent, often occurring in diorite or gabbro.

Pegmatite is a granitic rock consisting of quartz and feldspar together with mica which, in a fluid state, has been injected into fissures in some other rock, under conditions which have permitted its material to cool slowly and its constituent minerals to crystallize and develop freely and fully and therefore to form large masses.

In all the gem-bearing dikes the outer zone or marginal portion at both sides is a micaless granite or aplite, a granular mixture of quartz and feldspar of moderately fine grain, owing its texture and condition to the more rapid cooling of the material at its contact with the country rock. Within a second zone, where cooling was more gradual, the feldspar and quartz appear in larger masses, and other minerals show themselves. Generally the first foreign mineral to appear is black tourmaline in its characteristic long prisms, usually imbedded in quartz. Garnet crystals, of small dimensions, are often visible, which through their higher gravity, when the dike lies nearly flat, gather in its lower portion, forming lines or bands and giving rise to the name of "Line rock." Graphic granite, a massive development of feldspar with angular quartz inclusions, also abounds in the second zone. The third or central zone is more irregular in the arrangement of its minerals and contains cavities of substantial size, bordered by and containing large crystals of quartz and feldspar. Filling these cavities in the Stewart vein at Pala are found the lithia minerals, lepidolite and amblygonite, and in the gem-bearing veins are found tourmaline; spodumene, var. kunzite; beryl, topaz and garnet; for the most part enclosed in a clay-like substance* which fills the cavities.

On account of these details of interior structure some observers have described the whole dike as a vein, but the conditions are clearly more complex. Through movements of the earth's crust, which resulted in the opening of wide fissures, the pegmatite dike material found its way toward the surface, but the fissures remained planes of movement and after the central portion of the dike had fully cooled and hardened, or perhaps even before, it was shattered and a new fissure opened through which gem forming mineral solutions might pass. Thus within the dike was formed a vein. In several of these dikes are undoubted fissures and gouges, particularly in the Tourmaline Queen, and there is evidence to confirm the view that the shoot-like cavities in which the gems occur, are portions of fault fissures within the dikes. It is true, all of the gems are not free in the clay, for some are locked or ''frozen'' into crystals of quartz. This, however, is unquestionably due to silicious solutions which flowed up through the secondary fissures and formed the quartz crystals which abound in them.

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*W. T. Schaller, Am. Jour. Sci., Vol. XVII, p. 191.

The persistent recurrence over a large area of similar phenomena in connection with these dikes is, indeed, striking. First came an intrusion of granite diorite or gabbro and later an injection of pegmatite into its fissures. Then occurred a secondary fissuring of the pegmatite and a flow of solutions depositing usually tourmaline and sometimes also beryl, kunzite, topaz, or garnet, together with quartz crystals. On the central axis mentioned below lithia minerals everywhere occur.

Such are the dikes which contain the gem bearing veins. Their chief localities are Pala, Rincon, Mesa Grande, Moosa Canyon, Ramona and Aguanga Mountain.

By referring to the accompanying economic map on which the gem and lepidolite deposits have been plotted, it will be seen that Pala, Rincon and Mesa Grande lie in a line which bears about north 50° west and therefore coincides in general direction with the axis of the granite ranges and the strike of the metamorphic rocks. These gem deposits and the lepidolite deposit on Granite Mountain southeast of Banner, are on a central axis, Ramona and the Moosa Canyon locality lie in a parallel line about 8 miles southwest, and Aguanga Mountain is about the same distance northeast. The Pala dikes are mostly in diorite, as are those of Aguanga Mountain and Rincon, those at Mesa Grande are in gabbro and the others are in granite. Many conclusions might be drawn which would require further field work to confirm them, but the repeated occurrence of the lithia minerals, kunzite and lepidolite, in a gem-bearing zone 40 miles long, is highly interesting. The Riverside County kunzite locality near Coahuila lies some 23 miles northeast of the San Diego zone.

THE GEM DEPOSITS.

Pala.

Pala is a small village on the Indian Reservation of that name, in the valley of San Luis Rey River, about 28 miles from Oceanside. It takes its name from the Franciscan mission chapel of San Antonio de Pala. The gem bearing dikes here occur in three hills, or small mountains, immediately north and east from Pala village, rising 1,000 feet or more above the plain of the San Luis Rey River and lying within Secs. 13, 14, 15, 22, 23, 24 and 25, T. 9 S., R. 1 W., S. B. M. The dikes are of exceptional size and penetrate a country rock of granite and diorite. In several cases, erosion has removed the country rock above the dike or, in miner's parlance, the "hanging wall," so that the dike itself, for some distance, forms the surface of the mountain slope and is described by miners as a "blanket vein."

The westernmost hill, 1,800 feet high, called Tourmaline Queen mountain,[1] is cut by 4 approximately parallel dikes of slight southwesterly dip, the 3 lower being nearly horizontal in their intersection with the east face of the mountain. The lowest is of small thickness and minor importance, being known as the Douglass vein, from the Douglass claim located upon it. The next in altitude, on which are the Stewart and Mission claims of the American Lithia and Chemical Company, is about 400 feet above the arroyo bottom. This is exposed for a distance of 3,000 feet or more on the east side of the mountain, and its line of outcrops has a southward pitch of 5° from the horizontal. The chief feature of this dike, which is 40 feet or more in width, is a vein of lepidolite 10 to 20 feet thick, lying along the central plane. In the upper portion of this, at intervals, have been found pockets of amblygonite or lithia phosphate. The red tourmaline, rubellite, abounds imbedded in the lepidolite, in radiating masses. No abundance of gems has been found in this vein, but light pink kunzite and some gem tour-

Tourmaline Queen Mountain and Pala Chief Mountain. Looking Northeast from Pala. F.J.H.M. Photo.

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[1] Incorrectly called Pala Mt. in Bull. 37. Pala Mt. lies SE. and has no gem bearing dikes or veins.

maline have been taken from the north end of the Stewart claim and considerable quantities of small but fine green tourmalines have been taken from the Gem lepidolite mine, belonging to A. M. Labaugh, which adjoins the Stewart claim on the north. South of the Stewart is the Mission claim, on the south face of the hill and, on patented land still farther south, is the old Alvarado mine.

About 600 feet above the Lithia Company's dike and parallel to it, is the Tourmaline Queen dike. Its outcrop is hundreds of feet in length, its extent to the south having been limited by the erosion of the hill. The claim which bears this name is partly in Sec. 15 and partly in Sec. 22. The workings on it are quite extensive. This dike is about 14 feet wide and dips southwest 15°. On this mountain are also the Pala King and Homestake claims.

Tourmaline Queen Mine. Looking West from Pala Chief. F.J.H.M. Photo.

Dr. Eakle determines the country rock of the Tourmaline Queen as hornblende-diorite. A thin section shows large broad plates of dark green hornblende and plagioclase feldspar as essentially composing the rock. Smaller amounts of orthoclase and some irregular grains of magnetite are present.

Still higher, on the Tourmaline Queen Mountain is the Tourmaline King mine, belonging to F. B. Schuyler, of Berkeley, Cal. The outcrop is on the north face of the summit peak, the vein being about 7 feet wide and dipping 40° southwest. Other minor claims on the south face of this mountain are Maud and Happy Hooligan, also Buster Brown, formerly White Cloud, belonging to John Reed, of Fallbrook, and Adolph Shoulders, of Pala.

Pala Chief dike is the largest of all the gem bearing pegmatites. As the photograph shows, it is exposed on the west side of the summit of a hill, about 1,500 feet in height. It is about 1 mile east of Tourmaline Queen and lies mainly in the SE. ½ of Sec. 14. Its thickness seems to vary from 30 to 50 feet and it dips about 15° west. The hanging wall appears to be a mica diorite and the foot wall a granite, but over a considerable area the hanging wall has been removed by erosion so that it has been called a ''blanket vein.'' The gem material, chiefly kunzite, occurs in a reddish clay in pockets of considerable size. One of these was 3½ feet high and 20 feet long. Lepidolite in small masses is of frequent occurrence.

Pala Chief Mine and Hiriart Mountain. Looking Eastward from Tourmaline Queen Mountain. F.J.H.M. Photo.

The following are Dr. Eakle's determinations of the wall rocks:

Hanging-wall, dark hornblende-diorite. A thin section shows the rock to consist almost wholly of plagioclase feldspar and fibrous green hornblende. Magnetite occurs scattered throughout.

Foot wall, biotite-granite. A disintegrated granitic rock. A thin section shows biotite flakes, little plagioclase, considerable orthoclase and small amounts of quartz and hornblende. An occasional titanite crystal is seen.

The Pala Chief claim is one of a group of 5, the others being Ocean View, Goddess, Hazel W. and Knickerbocker. This group, together with the Tourmaline Queen, Pala King and Homestake, is controlled by the Pala Chief Gem Mining Company, of San Diego, Frank A. Salmons, president; R. Fenton, secretary.

South of the Knickerbocker claim is the Olla, owned by John Reed and Adolph Shoulders. South of Olla is Butterfly, owned by T. A. Blakely, of San Bernardino. This has produced some pink kunzite.

Pala Chief Dike and Mine, Looking East. F.J.H.M. Photo.

West of Hazel W. lies Redlands King, belonging to Mascart, of Redlands. East of Knickerbocker and Olla and south of Goddess is Redwings, belonging to B. T. Cooper, of Pala. This claim has yielded aquamarine beryls of inferior quality.

Hiriart Mountain. This hill, about 1,700 feet high, lies about 1½ miles southeast of Pala Chief, mainly in the SE. ¼ of Sec. 24, T. 9 S., R. 2 W., extending into Sec. 25. Here are numerous pegmatite

Mammoth Quartz Crystals. Pala Chief Mine.

dikes, varying in direction and dip, as shown in the photograph. The claims located on these are in 3 groups, based on ownership.

(A) Domingo Hiriart, Pala.
San Pedro.
Senpa.
Anita.
(B) M. M. Sickler, Pala.
K. G. Naylor.
Vanderberg.
White Queen.
Center Drive.
Fargo.
El Molino.
Hiriart.
(C) M. M. Sickler and D. Hiriart, Pala.
Katrina.

The White Queen claim is of historic interest as being the source, in 1902, of the first specimens of Kunzite discovered. This material was sent to Dr. G. F. Kunz, in New York, who identified it as Spodumene and subsequently it was given the variety name of Kunzite by Professor Charles Baskerville.

RINCON.

Bull. 37, pp. 137–39.

Gems have been found on the east side of the Rincon Indian Reservation between Pala and Mesa Grande, about 9 miles southeast of the former place. At this point the chief deposit was opened by J. W. Mack and is known as the Mack mine. It lies in Sec. 25, T. 10 S., R. 1 W. The dike is described as 5 to 6 feet wide with granite footwall and diorite hanging wall. The chief product was beryl of various colors, some of it deep blue. No work has been done here for some years, probably because the pocket became exhausted and the demand was not sufficiently great to justify much expenditure in searching for a new ore.

MESA GRANDE MINES.

Bull. 37, pp. 133–35.

The gem deposits of Mesa Grande lie about 1½ miles northwest of the Indian Rancheria. The principal properties are those formerly operated by the San Diego Tourmaline Mining Company and the Himalaya Mining Company. The latter control the SE. ¼ of SW. ¼ of Sec. 17, T. 11 S., R. 2 E. The holdings of the former are the NE. ¼ of NW. ¼ and NW. ¼ of NE. ¼ of Sec. 20, in the same township and range.

These properties, which adjoin one another, are both on the same fissure, which has been filled with an extensive pegmatite dike. This traverses the two properties, with a serpentine course, in a northwesterly direction for a distance of half a mile, the country rock being a dark green gabbro. The width of the dike varies considerably. At times its width is somewhat less than that of the drifts which have been cut in it and at times it is greater. The average might be stated at 4 feet. At the contacts on either side, the dike matter is a fine grained aplite but, in the center it is a coarse pegmatite, with frequent cavities, pockets and shoots in which the more perfect specimens of tourmaline and other gem material occur, imbedded in clay.

Dr. A. S. Eakle determines the country rock here to be a hypersthene-gabbro. A thin section shows the rock to mainly consist of labradorite feldspar and rounded crystals and plates of hypersthene with a sprinkling of magnetite. The hypersthene is pale red and shows pleochroism, pale red to pale green.

On the San Diego property the dike winds considerably in its course, and, at the south end of the property, has divided into two diverging forks or spurs. These have not yet been explored as far as the south boundary of the property, and have not been opened on the adjoining claim southward. In the beginning, throughout the two properties, the work was done by open cuts in which the gem bearing mass was mined for a depth of some 20 feet. After this had progressed to a certain point, it was found too expensive to prevent the sides of the open cuts from caving in. This work was, therefore, abandoned and further exploitation of the deposit was made by entering the dike at a lower level and working underground. On the San Diego property two cross cut tunnels were driven, the more southerly of which is over 200 feet long and cuts the two spurs above described. On this property the present level is about 200 feet vertically below the surface of the ground. The ground slopes northward until, on the Himalaya claim, the surface intersects the vein at the adit level. On the latter the main working is by an adit on the north outcrop of the vein, which has been mined for about half the length of the property.

At the present time both properties have been idle for some time. The San Diego tunnel has caved in and access is not at present possible. The Himalaya property is locked up and not open to visitors. The San Diego Tourmaline Mining Company's interests are now represented by K. G. Naylor of San Diego. The Himalaya Company is undergoing reorganization and a letter to the New York address brought no reply.

ESMERALDA MINE.

Bull. 37, pp. 136–37.

About 1½ miles west of the Himalaya property and in the east edge of SE. ¼ of SE. ¼ of Sec. 13, T. 11 S., R. 1 E., is the gem mine known as Esmeralda. This property is owned by the Native Gem Mining Company, the controlling interest being held by Dr. C. C. Vallé, Walter N. Burnell, and Mrs. Nicholson, all of San Diego.

Here is a wide dike nearly vertical, and about north and south in its trend, but, a few feet below the surface, branching upward to east and west. The workings are below the fork.

As described in Bulletin 37, this mine at one time produced some very interesting gem material, but it has long been idle and the portals of its adits have caved in. The gems are said to have occurred in pockets of large size but these pockets were somewhat far apart.

MOOSA CANYON.

Bull. 37, p. 62.

The locality is about 12 miles southwest of Pala and 3 or 4 miles southeast of Bonsall. In Bulletin 37, its position is stated to be in Sec. 26, T. 10 S., R. 3 W. The writer was unable to verify this, as one of the owners, Mr. T. A. Freeman, who was interviewed at Bonsall, declined to give any information about the position of the property. Later information, undoubtedly reliable, gives the location of this deposit as in the east half of section 27 of the same township and range.

There are said to be two claims, Vista Chief and Mountain Belle. Tourmalines have been found here, but not in large quantity. The reported occurrence of Kunzite here could not be verified. It is said that tourmalines have been found in Gopher Canyon, which lies 2 miles southwest of Moosa Canyon.

RAMONA.

Bull. 37, pp. 140–150.

The gem deposits here are noteworthy in that the dikes all occur in granite instead of in diorite or gabbro. No mining has been done here for some years, though in assessment work on unpatented claims some gems are produced.

The claims lie in T. 13 S., R. 2 E., on one mineral zone, which includes several dikes, and nearly all are in Sec. 8.

List of Ramona Gem Claims.

Name	Position	Owner	Address
29 Prospect	SE. ¼ SE. ¼ Sec. 6	H. A. Warnock; John P. Sutherland	Ramona.
30 A. B. C.	Pat. NW. ¼ NW. ¼ Sec. 8	Alexander McIntosh	Ramona.
31 Hercules Group	8 claims, Sec. 8	Dr. E. G. Logan; A. W. Pray	Escondido.
32 Little Three	Pat. NE. ¼ SE. ¼ Sec. 8	Dan McIntosh	Ramona.
		H. W. Robb; Peter Schnack	Escondido.
33 Cable	SE. ¼ NE. ¼ Sec. 8	Dr. Cable	Los Angeles.
Sunrise	NW. ¼ SE. ¼ Sec. 8	— Batcheller	Ramona.
Surprise	SW. ¼ SW. ¼ Sec. 9	J. E. Farley; Mrs. G. M. Stone	Ramona.

AGUANGA MOUNTAIN.

Bull. 37, pp. 123–24.

At present only one mine is being worked here. It is the Mountain Lily, 6 miles southeast of Oak Grove, located by Bert Simmons, owned by Dr. C. C. Vallé, of San Diego, and operated under lease by J. W.

Ware & Co., 1414 F street, San Diego. The dike is described as about 4 feet wide in diorite, the gem bearing vein being on the contact between the pegmatite and the hanging wall of diorite.

The special product at this time is a "Nile Green" tourmaline. These stones are very attractive in color but mostly small, not averaging much more than one carat, when cut. Fluorite in small quantity has been found here.

JACUMBA.

Bull. 37, p. 150.

Nine and a half miles east of Jacumba, near Mountain Springs, are some deposits of essonite garnet in crystalline limestone associated with gneiss. Some fine gems have been mined here under the name of California hyacinth. The San Diego Gem Company formerly held claims here, but they have lapsed.

Eight and a half miles northwest of Jacumba is the Crystal Gem mine. Here, in a pegmatite dike, have been found pink and green beryl and essonite garnet. Some 40 miles north of Jacumba, near Seventeen Palms, fine garnets have been reported as abundant.

(B) GEM MINERALS NOT YET COMMERCIALLY IMPORTANT.

The following minerals, while of interest as gems, are insufficiently abundant to be of commercial interest or, while occurring in gem quality elsewhere, are not known in this condition in San Diego County:

Corundum. Aluminium oxide. Bull. 37, p. 45.

H. 9, G. 3.9–4.1. Luster adamantine to vitreous. Colors all prismatic hues to colorless.

The common varieties of this mineral are used as abrasives under the name emery. Transparent corundum ranks among the most valuable of gems and includes the ruby and sapphire. Ruby is red corundum. Sapphire includes all colors except red, but the name is more particularly applied to the blue colors. Mr. W. H. Trenchard reports light pink corundum from a locality 26 miles east of San Diego, on the north slope of Mt. San Miguel, 8 miles northeast of Sweetwater Dam, where it occurs in hydromica schist associated with garnet. He also reports bluish corundum from Tule Mountain north of Jacumba.

Dumortierite, Basic aluminium silicate, Bull. 37, p. 71.

H. 7. G. 3.265.

Five miles northeast of Dehesa and 1 mile south of Alpine Heights, on the line between Secs. 4 and 5, T. 16 S., R. 2 E., is a large body of quartz, enclosing crystals of dumortierite. When cut and polished this makes handsome specimens and would be available for ornamental work. Thus far no commercial use has been made of this material.

Graphic Granite. Bull. 37, p. 79.

This material consists of large masses of feldspar, in which are angular individuals of quartz, resembling Hebrew letters. It appears in the pegmatite veins at Mesa Grande, Pala and elsewhere. When sufficiently solid and susceptible of polish it is available for ornamental work, boxes, vases, etc.

Labradorite. Lime—soda feldspar. Bull. 37, p. 80.

H. 6. G. 2.27. Colors, gray, brown, greenish.

The cleavable varieties show on their striated surfaces a beautiful play of colors like those of mother of pearl, caused by the phenomena of color interference. This mineral is reported from the gem mines but does not occur in especially good size or quality.

Vesuvianite. A Calcium-Aluminium Silicate. Bull. 37, p. 93.

H. 6.5. G. 3.35–3.45. Color brown to green.

This mineral in gem quality, is reported by W. H. Trenchard from Jacumba and San Vicente.

Axinite. A silicate of alumina, calcium and manganese, with some iron, and magnesia and also boric acid and water. Bull. 37, p. 96. Color, clove brown, plum blue, violet, pearl gray, honey yellow and greenish yellow.

In 1904 a discovery of this mineral was reported near Bonsall, 12 miles southwest of Pala, by Thos. A. Freeman. This was at the Moosa Canyon tourmaline locality.

Lazulite. Aluminium phosphate, with some magnesia and water.

H. 5.6. G.3. Color azure blue. Bull. 37, p. 98.

A specimen of this mineral was reported from the vicinity of Oceanside in 1893. State Mining Bureau Museum No. 13591. As there are no crystalline rock outcrops near Oceanside, this may have been drift or float material.

Epidote. Silicate of alumina, iron and lime, with some water. Color yellow-green, pistachio-green to red-gray and colorless. Bull. 37, p. 99.

H. 6–7. G. 3.2–5.

Found in clear transparent crystals at the McFall mine, 7½ miles southeast of Ramona. These were handsome crystals of gem quality.

Lepidolite. Lithia mica; Silicate of alumina and lithia with flourine and water. Bull. 37, p. 100.

H. 2.5–5. G. 2.84–3. Luster pearly. Color rose red, violet gray, lilac, yellowish, grayish, white, translucent. In rhombic crystals or granular massive.

The massive variety is used to some extent for ornaments such as ash trays, dishes, vases and paper weights. The chief deposit in this county is at Pala, in the Stewart vein.* In small quantities it occurs in all the veins at Pala and at Mesa Grande and at the Royal mine, southeast of Banner.

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*(See Lithia Minerals, this Report, p. 76).

Chrysocolla. Hydrous copper silicate. Bull. 37, p. 101.

H. 2–4. G. 2–2.2. Color, various shades of green.

When occurring in masses of sufficient size, this mineral is cut for table tops and similar decorative purposes. In small masses it is used to some extent for jewelry. One specimen is in the State Mining Bureau Museum, locality not given. No. 7187.

Apatite. Calcium fluophosphate with some chlorine. Bull. 37, p. 102.

H. 5. G. 3.17–3.23. Color green to blue. Occasionally yellow, brown, red or gray.

Reported from Dos Cabezas mine, near Jacumba.

Fluorite. Calcium fluoride. Bull. 37, p. 102.

H. 4. G. 3.18. Luster vitreous. Color varied. White, yellow, green, blue, violet, crimson, rose, pink and brown.

This mineral, though rather soft, is often cut into paper weights, vases and other ornamental articles. It has been reported from the Mountain Lily mine on Aguanga Mountain.

Gold Quartz.

Bull. 37, pp. 68–9.

Auriferous quartz in which the gold occurs in conspicuous filaments and masses has long been used in certain forms of jewelry, such as brooches, links for watch chains, inlaying watch cases, etc. In the bonanza days of gold mining in this county, much of this material was found at mines near Julian, the Ready Relief in particular being quite productive.

ABRASIVES.

Under this head are properly included corundum or emery, quartz and garnet. The first, reported from the north side of Mt. San Miguel, is not in commercial quantities. Quartz, which is extensively used in the manufacture of sand paper, is found at many points in San Diego County, but there is not yet evidence of a sufficiently large market to justify the establishment of a factory and the material is not valuable enough to stand the expense of much transportation.

Garnet, which is used in making sandpaper for finishing wood and leather, is found in substantial quantity at the McFall mine, owned by John McFall, of Ramona, 7½ miles southeast of Ramona, on the east of the San Vicente Grant, SE. ¼ of Sec. 17, T. 13 S., R. 2. E. Here a shaft has been sunk 22 feet in solid garnet, which occurs in pockets in diorite.

Another deposit of massive garnet is in Sec. 25, T. 13 S., R. 8 E. Claims have been located on this by Bert Simmons, of El Cajon, and Homer Bailey, of San Diego.

Near Dos Cabezas Springs and within 1 mile of the San Diego and Arizona Railroad survey are a number of deposits of garnet suitable for abrasive purposes.

LITHIA MINERALS.

Bulletin 38, pages 306-10.

Lithia is used in commerce for medicinal purposes, in artificial mineral waters and in tablets. On account of its red flame the nitrate is used in making red fire.

This substance occurs in several minerals, the principal ones being lepidolite, amblygonite and spodumene. The first occurs in commercial quantities at Pala and in smaller amount at many points. The second occurs also at Pala, in small quantities, associated with the first. A rare variety of spodumene, called kunzite, also occurs at the same locality but as a gem mineral and not as a source of lithia.

Lepidolite, lithia mica, has a complex composition. The general formula given by Dana is $KLi[Al(OH,F)_2]Al(SiO_3)_3$. Analyses of specimens from different localities, show percentages of lithia ranging from 3.87 to 5.88. It occurs usually in scaly, granular masses, sometimes in aggregates of short six-sided prisims. The cleavage is basal, luster pearly, and the color rose-red, violet-gray and yellowish, or grayish white to white. Its hardness is 2.5 to 4, its specific gravity 2.8 to 2.9. It fuses easily to gray or white glass and colors the blow pipe flame red. It is distinguished from other micas by its fusibility by the red flame and by the reaction for fluorine.

Amblygonite is a fluophosphate of lithia and alumina, containing 10 per cent of lithia. It crystallizes in large coarse crystals in the triclinic system. Its hardness is 6, its specific gravity 3.01 to 3.09. The color is white to pale greenish, bluish, yellowish or brownish white. The Pala material is almost entirely white and to the eye closely resembles a feldspar, but it fuses easily in the blowpipe flame and tinges the latter red. Should the mineral be found in commercial quantity, it will be more valuable than the preceding, since it contains a larger percentage of lithia and the phosphoric acid is valuable as a by-product.

Spodumene, var. Kunzite, is a lithia alumina silicate, containing 8.4 per cent of lithia. It is found at Pala, but is not a commercial form of lithia. Its characters are given under the head of Gems.

As already stated under that head, these lithia minerals occur in San Diego County, on a northwesterly trending axis, parallel to the strike of the granite ranges and extending from the old Royal mine, southeast of Banner, through Mesa Grande to Pala.

The Royal mine lies southeast of Banner on the southwest slope of Granite Mountain, in Sec. 18, T. 13 S., R. 5 E. Lepidolite occurs here in a pegmatite dike and, from all accounts, the quantity is quite limited.

The property, which has never been productive, is said to belong to Henry Blumenberg, Jr., of Los Angeles.

At Mesa Grande, lepidolite occurs in small masses, in the gem bearing veins on the San Diego, Himalaya, and Esmeralda properties. Commercially the quantities are insignificant. The Rincon locality is on the Pala axis, but lithia minerals have not been reported.

This widespread and persistent lithia mineralization culminates at Pala, where are the commercially important deposits of lepidolite and also those of the gem mineral kunzite.

Here as shown in the photograph on the east side of Tourmaline Queen Mountain, about 400 feet above the base, is exposed a great pegmatite dike 35 to 45 feet wide, and nearly horizontal in its main outcrop, which strikes about north 7° east and dips to the south about 5°. Westward the dike dips 10° to 15°. It is exposed for a length of 3,000 feet or more, from north to south, and has been opened at several points. Filling a fissure in this dike, somewhat below its central plane, is a vein of lepidolite from 15 to 20 feet thick. Throughout the lepidolite, radiating masses of rubellite or pink tourmaline occur abundantly and in occasional pockets are masses of amblygonite. As stated, the wider portion of the dike is above the lepidolite and the amblygonite, when found, was mostly in the lower part of the pegmatite above the lepidolite. About 30 tons of amblygonite were shipped from this mine and it is not known whether any substantial quantities remain. It was found mostly west of the ridge under which the dike passes. From each face of the hill, a tunnel was driven and, as they did not quite coincide

Stewart Lithia Vein. Looking West from Pala Chief. F.J.H.M. Photo.

in level, they were connected by a short winze. The lepidolite was chiefly mined from the east tunnel and the ambylgonite from the west.

The principal portion of the lithia vein is controlled by the American Lithia and Chemical Company, 206 Broadway, New York City; Wm. N. Crane, president; Theo. Ludlum, secretary. This company owns the claims known as Mission and Stewart. Adjoining the latter to the north, is the Gem Lepidolite Mine, belonging to A. M. Labaugh, of Pala. The American Lithia and Chemical Company also owns a half interest in the Douglas claim on the small vein at the foot of the hill. The remaining interest is held by T. A. Blakeley, of San Bernardino.

While this Pala lepidolite deposit is of great size, its tonnage having been estimated at from 500,000 to 1,500,000 tons, the writer is informed that only 5 cars of 30 tons each have been shipped from the property, but there are said to be over 1,000 tons of ore on the dump and this has been reported under the head of production. Its distance of 28 miles from railroad, at Oceanside, should not add more than $4.00 a ton to the cost of production, and it is greatly to be hoped that an adequate market will soon be found.

Small masses of lepidolite are found in the veins of the Tourmaline Queen and Tourmaline King mines, on the same mountain. In the Pala Chief vein also, the lithia mica occurs in small quantities. It is also found in the gem bearing veins on Hiriart Mountain, but not in substantial tonnage.

PETROLEUM.

Petroleum of commercial interest has not yet been discovered in this county, although several wells have been and are being drilled and the operators of these seem quite hopeful of success. In several wells small amounts of gas have been encountered and occasional layers of sandy material, with suggestions of oil, have raised the hopes of the driller, but nowhere has oil been found in measurable quantity.

It is of interest to note that the middle Miocene beds which are the chief reservoirs of oil in the San Joaquin Valley and in Orange County, have not been identified in the county of San Diego, and the deepest wells in the latter have passed through all the Tertiary beds and the Cretaceous strata and have penetrated a black shale, sometimes calcareous, which is probably of Jurassic age. It is evident, therefore, that, if oil be found, it must occur in beds of different geologic horizon from those constituting the commercial oil reservoirs to the northward.* It would, perhaps, be unwise to say that it is impossible for oil in commercial quantities to be found in other horizons, in southern California but, thus far, we have no information that will justify the expectation that, in this region, it can be found in older strata than those yielding oil farther north.

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*See Ralph Arnold, Bulletin Am. Inst. Min. Eng. March, 1914, pp. 406-11.

The chief encouragement to drill for oil in western San Diego County is stated to be the frequent occurrence, on the beaches, of masses of asphaltic residue or brea. The assumption is, that this material has come from submarine seepages and, from this idea, has sprung the hope that by drilling near the coast it might be possible to reach oil sands from which the inferential seepages may have come. In order to determine what evidence of seepage there might be in the waters near the San Diego coast line, a letter was addressed to Dr. Wm. E. Ritter, director of the Biological Station, near La Jolla, asking whether he knew of any submarine seepages. His reply is given herewith:

THE SCRIPPS INSTITUTION FOR BIOLOGICAL RESEARCH OF THE UNIVERSITY OF CALIFORNIA.

LA JOLLA, CALIFORNIA, November 18, 1913.

Mr. F. J. H. Merrill, Oceanside, Calif.

DEAR SIR: Replying to your letter of inquiry about petroleum in the ocean in this vicinity, I would say that we have seen no signs of it south of Redondo. It may be further stated, that our explorations of the sea over most of the continental shelf in this locality have been so extensive that, did outflows comparable with those in the Santa Barbara Channel exist here, they could hardly have escaped our notice.

Small fragments of asphaltum do occur, here and there, on shore rocks in many places, but I have always supposed they were brought from long distances—probably from the north.

Yours very truly,

WM. E. RITTER, Director.

In conclusion it may be said that while the search for petroleum in this region by persons with capital to spare for the investigation, is most laudable and evinces in a high degree the existence of a most cordial public spirit, it is not a matter to be undertaken by persons of limited means. As "twenty swallows do not make a summer," so a few bottles or even buckets of oil do not make a commercial oil field. The discovery here of a substantial oil field would be of incalculable value, but can not with certainty be anticipated.

Companies Drilling Oil Wells.

Lo Tengo Oil Company, 322 Timken Building, San Diego. President, A. J. Bradley; secretary, E. G. Dehm. Well one mile north of Tia Juana, NE. ¼ of NE. ¼ of SW. ¼, Sec. 31, T. 18 S., R. 1 W., 3,290 feet deep. Began 1911.

Tia Juana Valley Oil Company, 323 Timken Building, San Diego. President, A. C. Riordan; secretary, E. G. Dehm. Well 2½ miles south of Nestor. Lot 4, Sec. 9, T. 19 S., R. 2 W., 760 feet deep. Began 1910.

Otay Oil Company, American National Bank Building, San Diego. President, H. K. John; secretary, H. W. Archer. Well southeast of Otay, NE. ¼ Sec. 30, T. 18 S., R. 1 W. 2185 feet deep. Began 1910.

Balboa Oil Company, 629 Spreckels Theater Building, San Diego. President, A. J. Taylor; secretary-treasurer, John Wiseman. Well in Mission Valley, Pueblo Lot 1105, 3,352 feet deep. Began 1911.

San Elijo Oil Company, 554 McNeece Building, San Diego. President, J. McNeece; secretary, J. B. McNeece. Well southwest of Sorrento railroad station. Pueblo Lot 27, 1,700 feet deep.

Laura F. Clark Oil Company, formerly Panama-American Oil Company. President, Mrs. L. F. Clark, Encinitas. Well near La Costa. NE. ¼ of NW. ¼, Sec. 26, T. 12 S., R. 4 W. 2,265 feet deep.

Pacific Laguna Oil Company, President, A. R. Damarus, 217 Timken Building, San Diego; secretary, T. W. Dryden. Well near La Costa, SW. ¼ of SW. ¼ of Sec. 26, T. 12 S., R. 4 W. 1,400 feet deep.

The logs of the San Diego County oil wells are of much interest, but have not been kept with uniform precision and it is not easy to compare them. The drillers' descriptions are not always easy to understand geologically, but it is not difficult to note the conspicuous passage from the sands and the brownish clays of the Tertiary and Cretaceous, which we know at the surface, into gray, blue and black shales and calcareous beds, which probably belong in the Jurassic or Franciscan.

The log of the Balboa well is here given in full. That of Lo Tengo, which is also given, does not differ materially except that their surface heights being different, the changes in formation occur at different levels. These two and the Otay well appear to be the only ones which have penetrated into the hard formations below the Cretaceous.

The bottom of the San Elijo well is in the brown shale which is probably, in part, Cretaceous.

Wells of moderate depth have been drilled at Chula Vista, La Jolla and near Poway, but without finding oil.

Log of the Balboa Oil Well (1913).

Surface height, 15 feet.

	Thickness, feet	Depth, feet
Quicksand, gravel and shells	80	80
Sand and boulders	66	146
Shale blue and brown	179	325
Hard white shell lime	10	335
Water sand (artesian flow)	15	350
Shale blue and brown	150	500
Hard shell	10	510
Water sand	15	525
Shale mixed strata	175	700
Hard white shell lime	25	725
Water sand	175	900
Hot Water	100	1,000
Sand, shell and boulders	226	1,226
Sand and shale	74	1,300
Hard shell lime	25	1,325
Shale brown (clay stiff enough to stand up)	885	2,210
Hard blue lime	37	2,247
Water sand, blue shale	63	2,310
Blue black limestone gas? (new company began operations here)	100	2,410
Hard shell dark	144	2,554
Dark gray hard	5	2,559
Dark gray hard	12	2,571
Dark gray softer	4	2,575
Dark gray very hard	16	2,591
Dark gray softer	15	2,606
Dark gray hard	12	2,618
Dark gray softer	4	2,622
Light gray	15	2,637
Shell	9	2,646
Shale	4	2,650
Dark hard lime shell	22	2,672
	2	2,674
Blue shale	4	2,678
Dark hard line shell	16	2,694
Blue shale	3	2,697
Alternating shale and limestone	18	2,715
Blue lime	145	2,860
Blue shale	2	2,862
Dark blue lime	16	2,878
Hard blue lime	16	2,894
Dark blue lime	26	2,920
Light blue lime	22	2,942
Light blue lime mixed with white lime	5	2,947
Hard black slate and lime	3	2,950
Black slate	28	2,978
Blue black lime	7	2,985
Black slate	10	2,995
Gray sand rock	5	3,000

Log of the Lo Tengo Oil Well.

Surface height, 375 feet.

	Thickness, feet	Depth, feet
Sandy clay	20	----------
Sand and shale	20	40
Soft light yellow sand	200	240
Conglomerate	70	310
Hard shell	10	320
Soft red sand	37	357
Soft yellow sand	43	400
Blue shale	45	445
Soft sand and blue shale	50	495
Yellow clay	35	530
Yellow sand	42	572
Sticky clay	5	577
Blue clay	28	605
Gray sand	35	640
Blue clay	25	665
Blue clay	55	720
Blue shale	25	745
Sandy shale	50	795
Blue shale and clay	65	860
Light brown shale	505	1,365
Black sand	70	1,435
Brown shale	15	1,450
Black sand	37	1,487
Brown shale	15	1,502
Sand and conglomerate	38	1,540
Dark shale	55	1,595
Brown shale	20	1,615
Sand	15	1,630
Sticky blue clay	50	1,680
Blue shale	38	1,718
Red sand	17	1,735
Blue clay	208	1,943
Hard calcareous rock	472	2,415
Hard fine sand	40	2,455
Calcareous sand rock	27	2,582
Dark sand, gas	18	2,600
Calcareous rock	200	2,800
Conglomerate	32	32
Sand gas	13	45
Calcareous rock, gas and "oil"	20	65
Calcareous rock, soft sand and gas	35	2,900
Hard calcareous sand, "Good showing of oil"	65	65
Soft sand "oil"	20	85
Calcareous rock, soft sand layer "oil"	50	3,035
Hard calcareous rock with streaks of sand and some gas	----------	----------

The Otay well is 2,100 feet deep. It is said hard rock was encountered at 900 feet. The surface height is about 400 feet.

COAL.

Lignite seams of limited thickness and extent have been reported from borings in the vicinity of San Diego, and tradition says that some thirty years ago a bed of coal exposed at low-water mark, in the beach near Del Mar, was worked as a source of fuel for blacksmith forges.

At the present time, with oil as a cheap and abundant fuel, there is no inducement to investigate or search for these small coal beds.

GRAPHITE.

This important form of carbon is much used for making pencils, for lubricant and for crucibles for foundry facings, for stone polish and for paint. But little has been found in this county. The chief occurrence is reported from near Mason's on the road from San Felipe to Carrizo Creek. As reported by Frank Stephens, of Julian, the graphite occurs in mica shist and the deposit is in Sec. 10, T. 14 S., R. 5 E. It belongs to Mr. Stephens and Thos. L. Works, of San Diego.

Other outcrops of graphite bearing material, are known in the same region.

SALT.

Bulletin 24.

There is no source of salt in San Diego County, except the water of the Pacific Ocean, from which it has been extracted at various points on the coast by solar evaporation. At the present time there are but two plants in operation in the county, both of them near San Diego. They are operated respectively by the Western Salt Company and J. P. Duncan's Sons.

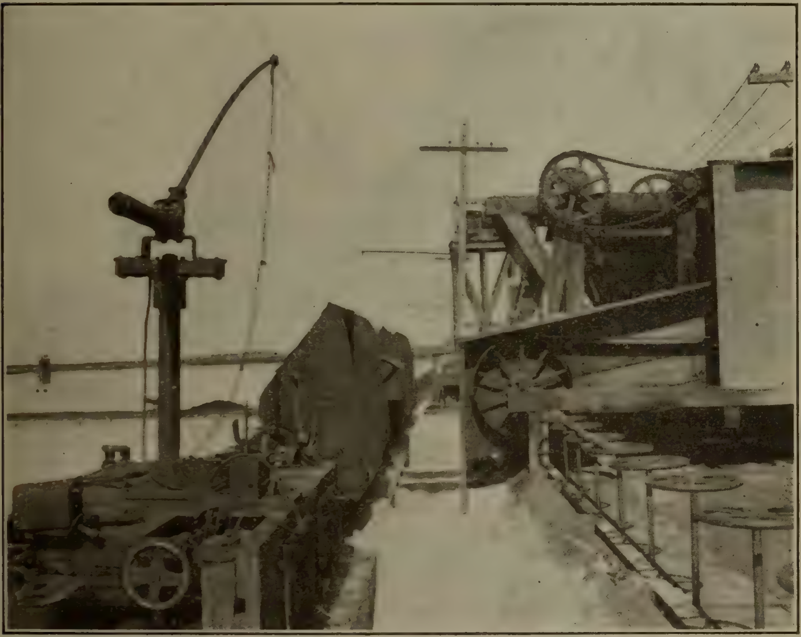
Western Salt Company's Plant. General View.

The Western Salt Company is not incorporated. Mr. E. S. Babcock is the chief owner of the enterprise. The plant is situated in the south end of San Diego Bay, the railroad station being called Fairfield. The holdings comprise about 900 acres of tide marsh, which by dredging and the building of dikes has been laid out in a series of inter-communicating ponds of slight depth. The six largest ponds adjacent to the bay are known as the tide ponds. During high tides, which occur about twice a month, these are filled with water from the bay which flows in at a strength of twelve to fifteen salinometer degrees and is retained by flood gates. The density in San Diego Bay is said to be greater than that of the water of San Francisco Bay. After staying in the tide ponds a short time the water is moved by pumps into the secondary ponds which are smaller and shallower, and greater in number. Here it again remains and is strengthened by solar evaporation and is transferred by gravity into the lime of pickle ponds, at this time having a density of about sixty-six degrees of the salinometer. In the pickle ponds the brine reaches a strength of one hundred salinometer degrees or a specific gravity of 1.201, by which time the gypsum, magnesia salts and other foreign matter have been deposited so that when moved from the pickle ponds into the crystallizing ponds it is freed from all objectionable impurities. In these crystallizing ponds, of which there are fifteen, when a specific gravity of 1.215 is reached, the salt begins to crystalize out, and at 1.235 to 1.252 specific gravity, salt of the first quality is deposited, after which the remaining brine, known as bittern water, is pumped off and allowed to seep into a part of the marsh. As the bittern water is withdrawn, new brine is transferred from the pickle ponds into the crystallizing ponds and thus the process continues until the salt deposit has reached a depth of eight or ten inches. This is considered a practical maximum, since if a greater depth is permitted to form, it becomes so compact that it takes an excessive amount of labor to break it up. A depth of nine inches is estimated to yield 1,800 tons per acre.

Western Salt Co. Harvesting.

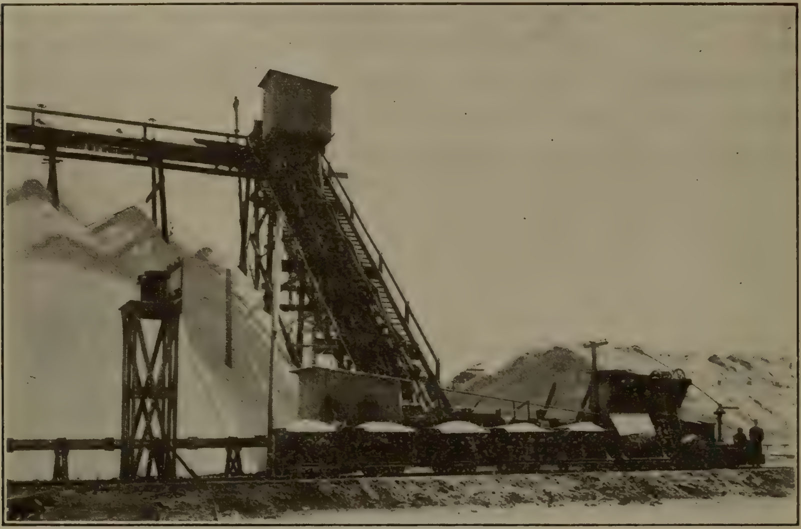
When the desired thickness of salt has been deposited the pond is drained and a crew of men is set to work to harvest the salt. Movable tracks are laid on the bottom of the pond and small dump cars, similar to ore cars, moved by gasoline locomotives, are used to receive the salt which is loaded by shoveling. From the pond where the salt is harvested the loaded cars are transferred to a small electric railway which runs along the crystallizing ponds, and thence go to the washing plant, where the salt is raised by a bucket conveyor and distributed into piles.

The methods of washing and elevating are ingenious and effective. From the cars the salt is dumped into a trough, at the bottom of which is a screw conveyor. This carries the salt to a small bucket conveyor, which lifts it a few feet up into a washing trough. Here, as the salt is moved along by a screw conveyor, it is washed by a current of saturated brine flowing in the opposite direction. From this washing trough, the salt is raised by a conveyor having buckets made of wire mesh. These successively pass under a stream of brine, which washes out any remnant of foreign matter which may be adhering to the salt. During the ascent, a final washing is given with a spray of fresh water. This conveyor raises the purified product to the top of a trestle about a hundred feet high and discharges it into a long trough through which, by screw conveyors, it is transported to be dumped at convenient points in storage piles to await the demand of the market.



Western Salt Co. Salt Washing Equipment.

The present production is about 15,000 tons and arrangements have been made to increase this to nearly 40,000 tons during the next year. The harvest season begins about September 1st and lasts through about three months. The salt is used for curing fish and hides, shipments being made as far north as Alaska for the former purpose. It is also used in the manufacture of ice cream and in various forms of business in which coarse salt is used. The following analyses show its composition and purity:



Western Salt Co. Salt Stacker.

STAUFFER CHEMICAL COMPANY.
Laboratories.
San Francisco, Cal., October 30, 1912.

Constituents determined	Per cent			
	No. 1 Old salt unwashed	No. 2 Old salt washed	No. 3 New salt unwashed	No. 4 New salt washed
DRY SALT.				
Insoluble in water	.084	.050	.044	.054
WATER SOLUBLE.				
Calcium sulphate	.224	.203	.202	.179
Calcium chloride	.194	.050	.186	.046
Magnesium chloride Magnesium sulphate	.606	.296	.331	.215
Sodium sulphate	.350	.121	.317	.110
Undetermined	.087	.071	.065	.079
Sodium chloride	98.455	99.209	98.855	99.317
(Including small amount of potassium chloride, and iron and aluminium sulphate)	Trace	Trace	Trace	Trace

E. C. MISSBACH, Analyst.

The Chollas Valley Salt Company, controlled by J. P. Duncan, 1420 National avenue, San Diego, has a small plant. Its production amounts to 600 to 700 tons yearly.

PHOSPHATES.

Minerals containing phosphoric acid are in demand as a source of this material for fertilizer, but no deposits of commercial importance have yet been found in San Diego County. Two occurrences have, thus far, been reported. One is said to be apatite, in crystalline limestone, near the Grapevine camp in Sec. 26, T. 11 S., R. 4 E. This was, at one time, controlled by David McGregor, of the Montezuma Mining Company.

Another is a deposit of white calcareous material forming a layer or stratum in the mesa east of Otay. This shows, on analysis, less than 2 per cent of phosphoric acid and is, therefore, not available commercially. Apatite, in limestone, is also reported from the vicinity of Jacumba.

WATER.

This is probably the most important of all minerals. Raised from the ocean by evaporation, transported in the clouds and fogs and precipitated by fall of temperature, water deserves the greatest attention and the most energetic form of conservation.

In San Diego County, the chief rainfall is on the west slope of the divide and, in the mountains, averages 30 inches per year. Taking into consideration the fact that a substantial percentage of this area is stony and unfit for agriculture, we see that, if conserved, the run off from the western slope should be ample to irrigate all the arable land.

For details of rainfall, the reader is referred to the records of the U. S. Weather Bureau and for measurements of stream flow to Water Supply Paper No. 300, U. S. Geol. Survey.

MINERAL WATERS.

A number of mineral springs have long been known in this county, some of them having a high reputation as curative agents. For some years the annual production and sale of bottled water has been considerable, but of late, it has declined, possibly through the increasing out-of-doors habit of living, which has come with the development of the automobile. The principal springs are here enumerated.

The Coronado Spring.

This spring is southwest of Otay, in Sec. 22, T. 18 S., R. 2 W. An analysis by C. Gilbert Wheeler gives the following composition:

Analysis	Grains per gallon
Sodium chloride	10.168
Potassium chloride	.912
Potassium sulphate	.552
Magnesia sulphate	4.728
Calcium carbonate	6.488
Calcium sulphate	1.328
Peroxide of iron	.040
Silica	1.080
Organic	.992

This water is not, at present, in commercial use.

Nuvida Mineral Spring.

This spring, about 10 miles east of San Diego and formerly known as Isham's Spring, is in the Jamacho Grant, north of the Sweetwater Reservoir. It is owned by W. Freeland Kendrick, 8 South Eighteenth street, Philadelphia. W. C. Sherman, of Spring Valley, is the local manager. During the past year no water has been placed on the market.

Analysis	Grains per gallon
Sodium chloride	16.32
Potassium chloride	1.98
Magnesium chloride	10.10
Calcium chloride	2.93
Calcium carbonate	11.19
Magnesium sulphate	3.48
Iron peroxide	.03
Manganese carbonate	.17
Silica	3.09
Alumina	.09
Total solids per gallon	49.75

A mineral spring belonging to F. W. Bradley, of San Diego, is about 4 miles north of Foster in Sec. 12, T. 14 S., R. 1 W. No analysis is available, but the solid contents are given at 8 grains per gallon of which 5 grains are sodium chloride.

El Granito Mineral Springs Company.

Manager, C. C. Goldsberry. Main Office, 1015 Twenty-first street, San Diego.
Branch Office, 1065 Second street, San Diego.

These springs are owned by William H. Fisher and are about a mile southeast of El Cajon, in 70 acres of the El Cajon Grant, described as the SW. $\frac{1}{4}$ of SW $\frac{1}{4}$ and E. $\frac{1}{2}$ of NW. $\frac{1}{4}$ of SW. $\frac{1}{4}$, Sec. 14, T. 16 S., R. 1 W.

The curative properties of these waters in regulating the digestive functions have been known from earliest times and were greatly valued by the Indians.

Analysis.

By Joseph Luce, Salt Lake City.

U. S. gallon of 231 cubic inches contains—

	Grains
Sodium chloride	2.448
Potassium carbonate	6.810
Sodium bicarbonate	14.164
Sodium carbonate	7.390
Potassium sulphate	.168
Magnesium sulphate	16.873
Aluminum oxide	.540
Calcium oxide	.392
Iron oxide	Trace
Silicium oxide	.927
Carbonic acid (free)	2.216
Organic matter	Trace
Total	51.928

The company is equipped with a bottling plant in operation since June, 1913. The monthly output is from 800 to 1,000 gallons.

Warner's Hot Springs.

These springs, long known to the natives as Las Aguas Calientes, are situated at the northeastern margin of the old grant, known as San Jose del Valle, and by county highway are about 67.6 miles from San Diego.

The property is controlled by a syndicate which conducts a hotel and sanitarium on the property. Manager, F. S. Sandford. The postoffice is known as Warner Springs. The temperature of the water is stated at 148° F. and the analysis is given as follows:

	Grains per U. S. gallon
Sodium sulphate	5.65
Sodium sulphide	3.53
Silica	3.44
Sodium silicate	2.64
Sodium carbonate	2.63
Sodium	2.39
Potassium sulphate	0.43
Calcium silicate	0.38
Calcium phosphate	0.11
Ammonium	0.09
Magnesium sulphate	0.09
Sodium biborate	0.09
Ferric oxide	0.04
Lithium	Trace
Strontium	Trace
Magnesium oxide	Trace

Buckman Springs.

Buckman Springs Mineral Water Company, 515-516 Union Building, San Diego. President, Geo. W. Walker; secretary, T. B. Cosgrove. These springs are about 60 miles east of San Diego in Sec. 20, T. 16 S., R. 5 E. The company has recently bought the springs and hotel with 160 acres of land. The water is bottled, charged with natural gas and shipped in large quantities, being recommended for rheumatism and similar ailments. An analysis by Smith, Emery & Co. follows:

	Grains per U. S. gallon
Silica (SiO_2)	5.55
Alumina (Al_2O_3)	0.43
Iron bicarbonate ($Fe(HCO_3)_2$)	2.45
Calcium bicarbonate ($Ca(HCO_3)_2$)	61.90
Magnesium bicarbonate ($Mg(HCO_3)_2$)	10.18
Magnesium sulphate ($Mg SO_4$)	4.75
Calcium sulphate ($Ca SO_4$)	0.86
Magnesium chloride ($Mg Cl_2$)	2.09
Manganese perchloride ($Mn Cl_4$)	Trace
Potassium chloride ($K Cl$)	1.21
Lithium chloride ($Li Cl$)	14.93
Sodium chloride ($Na Cl$)	47.65
Sodium nitrite ($Na NO_2$)	Trace
Sodium bicarbonate ($Na HCO_3$)	6.03
Total solids per gallon	158.03

	Parts per million
Free ammonia (NH_3)	0.082
Albumenoid ammonia (NH_3)	0.086
Oxygen absorption	1.400
Free carbonic acid gas (CO_2)	730.5
Free carbonic acid gas (CO_2), expressed in cubic centimeters per liter, 0°Cent. and 760 m. m. pressure	371.7

On the old ranch known as Corral de Luz, lying just north of the Sta. Margarita Grant, about 18 miles northeast of Oceanside, there are said to be several mineral springs, but no analyses are on record.

At Jacumba are warm springs of medicinal properties and baths for visitors have long been established here. (See under the next head.)

Desert Springs and Wells.

In the desert areas, springs of potable water are of much importance, both to the traveler and to those who endeavor to develop or operate mines. Inasmuch as many years must elapse before sufficient capital can be invested to reclaim and utilize all the desert areas in this part of California, it will be useful to give here a list of the desert springs. The following information is chiefly taken from U. S. G. S. Water Supply Paper No. 224, prepared in 1908 by W. C. Mendenhall, mainly from data furnished by Professor Gilbert E. Bailey, who some years ago prepared for the State Mining Bureau, Bulletin No. 24 on the Saline deposits of California. It is not improbable that in the six years which have elapsed some local changes may have occurred.

"*Clark Well.*—This is in Sec. 8, T. 9 S., R. 6 E., near the northeast end of Clark Dry Lake, at an elevation of 555 feet.* Trails lead to it from Rock House Canyon on the northwest and from Coyote Creek Valley, and a little used wagon road connects near Borrego Spring with the road from Seventeen Palms Springs to Julian. The well can easily be found from its position north of the dry lake. The water is good.

"*Borrego Spring.*—This is in Sec. 17, T. 11 S., R. 7 E., on the west bank of the broad Borrego Wash, at an elevation of 452 feet. It is about 33 miles by wagon road from Julian. The water of this spring, although somewhat alkaline, is entirely usable. Mesquite trees grow near the spring and in the valley, and salt grass, willow, and rushes are abundant. An old cabin stands on the bank about 50 feet from the spring and serves to mark its position.

"*Seventeen Palms Springs.*—These springs lie in Sec. 35, T. 10 S., R. 8 E., at an elevation of 410 feet, near the junction of three washes in the clay hills, south of the Santa Rosa Mountains. At present only eight or nine palm trees stand near them, the remainder of the seventeen, from which the springs were named, having been destroyed by fire. The springs are about 12 miles by wagon road east from Borrego Spring, or 45 miles from Julian, but the road is little used, is dim, and may be difficult to follow, particularly after the winter rains. Broken clay hills and deep washes surround the springs. Grass and wood in small quantities may be found near them. When they are kept open the water is fairly good, but it becomes bitter and bad by neglect and disuse. The soil is impregnated with alkaline salts.

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*See Indio Quadrangle, U. S. G. S. The section, township and range numbers are supplied by the present writer.

"*Vallecito Springs.*—Vallecito Springs are in the valley of Vallecito Creek, Sec. 11, T. 14 S., R. 6 E., about 33 miles east of Julian, on the road to Carrizo station, at an elevation of about 1,600 feet. The old adobe stage station, in use when this road was a transcontinental stage route, still stands and is in fairly good condition. A watering trough stands near the building, and there are mesquite and cottonwood trees in the vicinity. The quality of the water is fair.

"*Hanna Well.*—This well is approximately in Sec. 36, T. 13 S., R. 8 E., at the base of the north slope of Black or Fish Creek Mountain, 15 or 18 miles southeast of Borrego Spring, and 10 or 12 miles southwest of Harper (or Mesquite) Well. It is not on a main road, but is near the mouth of a canyon heading in a pass that leads to the valley of Carrizo Creek. The water is good.

"*Agua Caliente Springs.*—About 3¾ miles eastward from Vallecito Springs and about ¾ of a mile southeast of the wagon road between Julian and Carrizo station there are several springs in a natural amphitheater comprising an area of about 50 acres. The water is tepid and impregnated with sulphur, but is not unpleasant to the taste. The combined flow of the springs makes a rather large stream. Grass and wood are scarce.

"*Mountain Palm Springs.*—These are in Sec. 12, T. 15 S., R. 7 E., at the foot of a high, broken rocky ridge and are several miles south of the main wagon road across the Sierra Madre, but can be easily reached by a side road that was made a few years ago. The water is cool and fairly good. Wild palms and other vegetation make the vicinity inviting.

"*Palm Springs.*—There are several palm springs in San Diego County, but those here referred to are about 9 miles east of Vallecito Springs, just north of the line between Secs. 25 and 36, T. 14 S., R. 7 E. The palms that gave the springs their name were destroyed long ago, but there are several mesquite trees near by. The springs are situated under a clay bank, and digging is sometimes necessary in order to obtain water. The water has a temperature of about 60° and is somewhat sulphurous.

"*Mason Ranch.*—Mason Ranch is in Sec. 1, T. 14 S., R. 5 E., on the road from Carrizo Creek to Julian and Agua Caliente (Warner's Hot

Springs). This is the principal road through this part of the desert, and may easily be followed. At the ranch an excellent supply of water has been developed.

"*Carrizo Station.*—This Station, Sec. 12, T. 15 S., R. 8 E. (elevation 450 feet), is near the left bank of Carrizo Creek wash, about 9 miles east of Palm Springs, on the main road from Julian to the Imperial Valley. There are a number of springs near the station, and two of them furnish fairly good water. There is also a rather large tule swamp around the station, from which a strong stream of alkaline water flows. Rough clay hills of late Tertiary age, showing typical bad-land erosional forms, are prominent features of this region. Carrizo was originally a stage station on the old line to Yuma, but the adobe buildings are now very dilapidated, their ruin having been completed by the earthquake of February, 1892.

"*Mountain Springs.*—These springs, in Sec. 24, T. 17 S., R. 8 E., are about 9 miles by road from Jacumba Springs and 33 miles from Campo, at an elevation of about 2,500 feet. Forty years ago there was a stage station here, on the Butterfield stage line from San Diego to Yuma. The ruins of the old stone corral and buildings are still visible. Water issues from the side of a rocky ravine and a portion of it is carried in an inch pipe about 200 feet to a trough beside the road. The quality is excellent.

"From Mountain Springs the road to El Centro passes through a rocky gorge in which water can be found a portion of the year.

"*Jacumba Springs.*—These are about 24 miles east of Campo, on the line between Secs. 7 and 8, T. 18 S., R. 8 E., and about ¼ mile north of Monument No. 233 of the international boundary, at an elevation of about 2,825 feet. They are all on the west side of the long, open valley of Carrizo Creek, whose outlet is to the northeast, through a deep narrow gorge, of which the greater part, including its head, is in Mexico. The springs include one of cold water and several that yield waters with temperature ranging from 86° to 98° Fahrenheit. These thermal waters are regarded as medicinal, and a bath house and other accommodations are provided for travelers."

The two foregoing groups of springs are on the automobile stage route from San Diego to El Centro, Imperial County.

CHAPTER II.

IMPERIAL COUNTY.

HISTORY.

This county formed part of San Diego County from the organization of the latter in 1851 to August, 1907, when it was separated and formed into a separate county by vote of the supervisors of San Diego County under an act of legislature giving them that power.

PHYSIOGRAPHY.

The most important feature of Imperial County is the broad and nearly level expanse of the Colorado River Delta which separates the Gulf of California from the Salton Basin and is generally known as the Imperial Valley. This basin lies in a synclinal valley bordering on the east the anticlinorium of the lofty granite ranges of San Diego and Riverside counties. Several small ranges of volcanics, metamorphic palæozic rocks and uplifted Tertiary beds, interrupt the general level of the delta plain and, on its eastern margin, is an extensive hilly area of volcanic rocks which continues eastward into Arizona. The great granite masses of San Diego County, barely appear east of the boundary line.

GEOLOGY.

In its general geology, Imperial County is closely linked with San Diego and, under that head, will be found a synopsis of the more important geological features. The chief item that is distinct is the history of the Salton Basin.

It appears that, in Tertiary time, this basin was the northern end of the Gulf of California, which extended some 160 miles farther north than at present, and extensive marine deposits were laid down, as shown by the marine Miocene fossils associated with the clays on its western margin. This condition of submergence probably continued after the close of the Tertiary and later, as the Pleistocene uplift of about 1,000 feet above present sea level which occurred on the Pacific coast of California probably involved this valley, a large part of the Tertiary Gulf of California became dry land. With the succeeding subsidence came another marine occupation of the valley. In the meantime, the delta deposits of the Colorado River, which debouched into this basin near Yuma, gradually increased in extent and altitude until they formed a natural dam of great width, isolating, from its connection with the gulf, that portion of the basin north of the present area of settlement. The Salton Basin was then occupied by a salt lake which, in that arid climate, was gradually dessicated and finally became dry, leaving behind large deposits of salt. From that time on, Salton Basin was alternately dry and flooded by the waters of the

Colorado as, from time to time, the river found its outlet toward the gulf or toward the north.*

The local Indian tribes have various traditions of the presence of a great lake in the valley and its existence is proven by the presence of great numbers of fresh and brackish water shells, which gave to the northern part of the basin, in Mexican times, the name of the Conchilla Valley, barbarized by later inhabitants into Coachella. There is, also, substantial evidence of this lake in the old beach line which has been traced around the basin at an altitude of about 40 feet above sea level.[1]

For this prehistoric body of water the name of Lake Cahuilla was proposed by its discoverer, Prof. W. P. Blake.†

The earliest inundation after the American occupation of the region occurred about 1849. The lake of that period also dried up and the Salton desert was without water until June, 1891, when another overflow of the Colorado River produced a lake 30 miles long and 10 miles in width.[2] This, in time, gradually evaporated and became much reduced in area, but in 1904, through the careless opening of the north dike or levee, in connection with the irrigation of the Imperial Valley, the river was again released and the Salton Basin was flooded and the submergence rapidly increased, doing great damage, until the Southern Pacific Railway Company, under presidential authority, closed the gap in February, 1907.

MINERAL RESOURCES.

While of no great variety in its mineral resources, Imperial County is not deficient in natural wealth as, apart from its great agricultural possibilities, its deposits of crystalline limestone and clay promise a great supply of building material which should make it a center of production for a very large area. Its production of metals also, may be important in the near future.

In the following pages these resources are briefly outlined.

GOLD.

The gold deposits of this county are in the southeastern corner, occurring in ranges with northwest trend, between the line of the Southern Pacific Railway and the Colorado River. They are also in the northwest extension of the famous gold belt of the Altar District of Sonora, Mexico. The persistence of this zone in direction, through a distance of many miles, is very marked, though it is not a zone of continuous mineralization. In Mexico the auriferous areas are separated by barren spaces, sometimes miles in extent, the precious metal being confined to metamorphic and sedimentary formations and not found in the granites which underlie them. This fact suggests that the latter are younger than the period of metallization.

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*See further U. S. G. S. Water Supply Paper No. 225, by W. C. Mendenhall, pp.17–20. Also U. S. G. S. Water Supply No. 300, by H. D. McGlashan and H. J. Dean, pp.29–33.

†Nat. Geogr. Mag., Vol. 18, p. 830.

[1] Wm. P. Blake, Pacific Railroad Reports, Vol. V, 1853.

[2] E. B. Preston, R. XI, pp. 387–393.

Of the ranges mentioned, that known as the Cargo Muchacho Range, in which are the Golden Cross, the American Girl, the old Cargo Muchacho mine and others, is of metamorphic gneiss and schist cut by pegmatite dikes, and lies 3 to 4 miles northeast of the line of the Southern Pacific Railway, its southeastern extremity being about 9 miles from Yuma. Along its major axis, which trends northwest, it measures about 9 miles and in a transverse direction about 5 miles. This range is surrounded by a gentle sloping plain or mesa and is divided into two nearly equal portions by a deep canyon trending southwesterly. In the northern section, sometimes called the Hedges Mountains, of which the summit measures 2,225 feet, are the Golden Cross mines and, in the southern section, of which the chief peak rises 2,130 feet, are the American Girl and the old Cargo Muchacho mine and others. In the various peaks and ridges, many auriferous veins have been found, and in all the gulches of the range and the washes leading from them, placer gold has been abundant. Northeast of this range, the plain or mesa, has an altitude of 750 to 900 feet and a width of some 4 miles, being succeeded toward the Colorado River by the mountains of the Picacho district, of which the chief summit, El Picacho, attains a height of 1,945 feet.

The Picacho hills, over an area of perhaps 100 square miles, are chiefly of volcanic lavas, tufas and conglomerates, but as shown in the deeply eroded areas, the volcanics are underlain by metamorphic schists and gneisses of various types which contain the chief gold deposits and may be equivalent in age to those of the Cargo Muchacho Range. The topographic features of this area are shown in detail on the U. S. Geological Survey topographic sheet known as the Yuma Quadrangle, as well as the position of the Golden Cross and American Girl mines.

Cargo Muchacho Range.

R. XIII, p. 333.

While the presence of gold in this region had been known from early times and had been the basis of dry placer mining on a small scale, it was not until after the completion of the Southern Pacific Railway to Yuma in 1877, that much underground mining was done. In 1878–79, a 20-stamp custom mill was built on the river about 6 miles below Yuma at the place called El Rio by Gillespie and Childs, under the name of the Yuma Mill and Mining Company. Here ore was treated, at first from the Cargo Muchacho mine and afterwards from the Golden Cross. The latter, having been the most productive of the properties in this district, will be described first:

The Golden Cross Mines.

R. XII, p. 240. R. XIII, p. 337.

In a re-entrant of the west margin of the Cargo Muchacho range, is the mining camp formerly known as Hedges, but rechristened Tumco by the United Mines Company, from the corporation title of which the abbreviated name is formed. Here is the group of mines known as the Golden Cross, from the former name of one of the claims, now relocated as the Missouri.

The original claim was located in 1884 by one Peter Walters, under the name of Little Mary. Soon, other claims were located and changed owners several times until, in 1893, the properties were taken over by the Golden Cross Mining and Milling Company. This was succeeded in 1897, by the Free Gold Mining and Milling Company, which in turn was superseded in 1910 by the United Mines Company, Dr. Milbank Johnson, President, 1215 Marsh-Strong Building, and D. S. Cook, Secretary, 805 Central Building, Los Angeles.

Pegmatite Dikes in Schist, Tumco. F.J.H.M. Photo.

At Tumco, the prevailing formation is a micaceous quartz schist, in part feldspathic, weathering brown on the surface and cut, in all possible directions, by a myriad of pegmatite dikes, varying from a few inches to a few feet in width. Undoubtedly, to these dikes the range owes, in great measure, its preservation from the erosion which has removed from view the larger portion of this formation formerly exposed above sea level.

The ore bodies at Tumco are in quartzose schist or gneiss, probably a metamorphosed arkose, and the mineralization parallels the stratification in certain layers of the schist. The mineralized beds dip about 30° southeast with a strike of north 34° east. In the past a very substantial thickness of the rock, from 15 to 25 feet, has been mined as ore, but some of this was of very low grade. The country is extensively faulted and at least two systems of faults exist. One of these, a major system, trends nearly northeast and southwest and the minor system has a trend nearly at right angles to this or a little east of south. There are three shafts and groups of workings in the camp known as Golden Queen, Golden Crown and Golden Cross. The two last are believed to be in the same stratum. The Golden Queen, which is 1,000 feet deep on the incline, is in a monoclinal fault block, north of that which contains the other two and it is probable that the two ore bearing strata were once continuous, faulting in the major system having displaced and cut off the Golden Queen block from that containing the others. The property is now under very careful and conservative management, being under bond to Seeley W. Mudd of Los Angeles, and keen ability is being directed to the discovery of ore beyond the secondary fault planes and to the development of the old ore bodies already opened. At the moment all work is being done on the Golden Cross. Here the shaft measures 1,200 feet on the incline. The Golden Crown is 1,100 feet deep on the incline.

The Golden Cross Mill, Tumco. F.J.H.M. Photo.

The property is well equipped with a 100-stamp mill, which has recently been fitted with a tube mill. The equipment in detail was as follows, in December, 1913.

One No. 5 Gates rock crusher;
One Robbins 18-inch conveyor with distributor over battery bins;
50 stamps equipped, but 20 running at present;
One 22′ by 5′ tube mill;
Two Akins classifiers;
One Dorr classifier;
Two 10″ by 54″ Frenier sand pump;
One Dorr thickener 36 by 12′;
Two Trent replacers 24 by 16′;
One air lift agitator 24 by 16′;
Two Trent replacers 25 by 16′;
Two special replacers 24 by 16′.

With necessary sump tanks, zinc boxes, etc. No amalgamation or concentration is used. Cyanide solution is added in the stamp battery. All slime product is treated by agitation and the Trent replacement process.

The Golden Cross group has been a noted producer of gold in the recent past, the production having amounted to several millions of dollars. The operations of Mr. Seeley W. Mudd were discontinued in September, 1914.

American Girl.

R. XIII, p. 331. Register Mines and Minerals, 1902.

This property about 5 miles northeast of Ogilby and 3 miles southeast of Tumco, was extensively worked some fifteen years ago. It is now controlled by the Imperial Reduction Company of Pasadena, R. Schiffman, president; MacD. Snowball, secretary; C. Terry DuRell, general manager.

The geological conditions are very similar to those at Tumco. The ore is quartzose vein matter and silicified country rock, carrying iron pyrites which contain the gold. The development work on the property was described in the Register of Mines and Minerals in 1902, as being 1,000 feet deep on the incline and no mining has been done for some years, but the mill has been newly equipped for the resumption of operations. The treatment will be by grinding in Hardinge mills, removing the slime to cyanide tanks and passing the sands over Richards classifiers from which they will go to Deister tables for concentration. The concentrates will be shipped and the slimes will be cyanided by the Trent replacement process.

Since the writer's visit, mining and milling have commenced at the rate of about 75 tons per day.

A cloudburst during the second week in November, 1914, flooded the lower workings and it is estimated that 4 months will be required to unwater the mine and open the shaft. (Min. and Sci. Press, Nov. 28, 1914, pp. 855–6.)

In addition to the two active properties above described, there are several others in this district of which some have scarcely been opened, while others have been worked and abandoned years ago. The following is a list of these properties:

Name	Location	Owner
Delta	Adjoining Golden Cross on the northwest	Thos. Johnston, Ogilby, Cal.
Banner Group, 6 claims	Adjoining Golden Cross on east	Larry Wren, Ogilby, Cal.
Mayata Englewood	Adjoining American Girl on west	Thos. Johnston, Ogilby, Cal.
Yuma Arizona	Adjoining American Girl on east	H. Randolph, Ogilby, Cal. J. Ernest, Los Angeles, Cal.

The foregoing six properties have never been producers but the following in years past have been productive. At this date there is nothing to be stated except the details of their history and so the reader is referred to Reports XI, XII and XIII and to the Register of Mines and Minerals of San Diego County.

Pasadena and southern extension or Mother Lode, 1 mile northeast of American Girl; $\frac{2}{5}$, Wm. Borthwick, Ogilby, Cal., $\frac{2}{5}$, P. B. Mathiason, St. Louis, Mo., $\frac{1}{5}$, Mrs. Irene Grimes, Pasadena, Cal. R. XI, p. 386. R. XII, p. 242. R. XIII, pp. 341, 343.

Guadalupe, 1½ miles northeast of American Girl; owner not known.

Blossom, 3 claims, 1 mile southwest of American Girl; John McEwan, Ogilby, Cal. R. XII, p. 238. R. XIII, p. 333. R. M. & M., p. 6.

Padre y Madre, adjoining Blossom on southeast; Mrs. S. B. Wright, San Bernardino, Cal. R. XII, p. 242. R. XIII, p. 343. R. M. & M., p. 6.

Cargo Muchacho (Pat.), 1½ miles southeast of Blossom. R. VI (Pt. 1), p. 81. R. XI, p. 385. R. XII, p. 239. R. XIII, pp. 333–4. R. M. & M., p. 6. Owner not known.

PICACHO.

This district, which lies near the Colorado River in T. 13 and 14 S., R. 22 and 23 E., has long been a seat of operations in vein and placer mining and the total production has been large. In the thirteenth report of the State Mineralogist, pages 331–346, will be found much detail about the mining claims and operations in this region in 1896. See also Register of Mines and Minerals, San Diego County, 1902.

Earlier records are to be found in the twelfth report, pp. 237-243.

About 1896 or 1897 came into this region one S. W. Dorsey, who undertook to consolidate all local interests in one large corporation.

From this movement resulted successively the following companies: California Gold King Mining Company, organized about 1902, next the California King Gold Company, and finally, about 1906, the Picacho Basin Mining Company. In these companies were included about thirty claims of which sixteen were patented including the old Picacho group; Apache, Dulcinea, Eastern California, Golden Casket, Golden Rule, Extension, Mina Rica, Tierra Rica and Helen May. Also the White Gold Basin mines formerly of D. K. Allen, deceased, of Picacho. Albert Polhamus, Alcyon, Alfonso, Golden Crown, Golden Dream, Golden Hill, Golden Sunshine, Jita, Oriental, Ponce de Leon. Also the D. C. Jayne mines: Goshen, Mars, St. George and Venus. There were besides 6 mill sites.

Mill of the Picacho Gold Basin Mining Co. F.J.H.M. Photo.

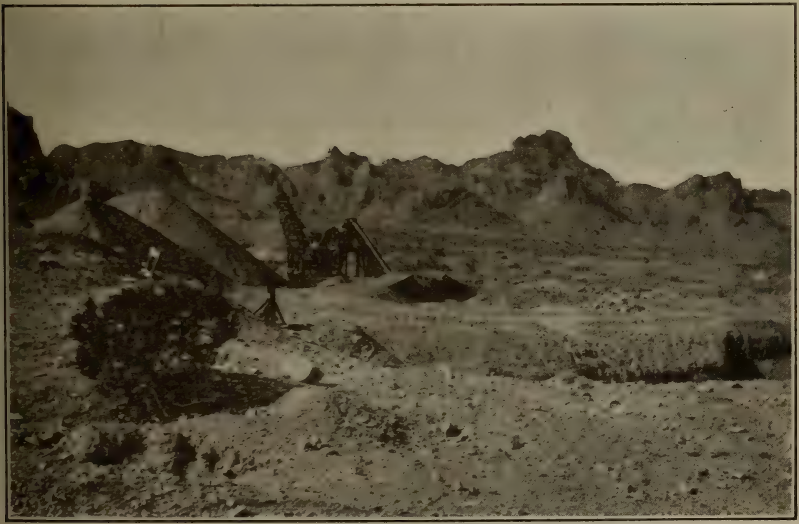
The chief production of these consolidated properties was about 1904–06. In 1908 the 450-ton mill, which at first was on the river 5 miles from the mines, was moved to the latter. They closed down in September, 1910. The ore, which was of low grade, occurred in lenses in schist, dipping at an angle of 45°. The last shoot worked was 250 feet long and 160 feet wide. The managers were successively: J. Emerson Gee, of Los Angeles; R. K. Humphreys, Burdette Moody, of Pasadena, and E. W. Carson, of Los Angeles. The properties were sold under execution October, 1912, and are now held by the Ridgeway Estate through The Quaker City Bank of Philadelphia.

At present, owing to the general depression in the mining industry there is nothing being done in this district except development work on some placer claims.

Along the arroyo, between the Picacho mine and the village, is a placer field on which several locations have been made. Wm. D. Sibley and T. A. Ashby have claims here and also Geo. Coryell, of Picacho.

Many of the old claims mentioned in the State Reports have been allowed to lapse and have been forgotten.

About seven miles by stage road in a direction N. 75° E. from Glamis are the old diggings of the Mesquite Placer, located in Sec. 21, T. 13 E., R. 19 E., at an elevation of 950 feet, the gravels lie along the washes of the present water courses, from the Chocolate Mountains, which drain into the bed of Dry Lake against the Sand Hills ten miles to the south. The placer gravels are in places fifteen feet deep but are not continuous and probably an average depth would not be over six feet. Water was packed from Glamis during the early work on the Bay Horse* claim and the gravels panned and run through rockers. Some dry placering has also been done. Although the deposits are not continuous, but cut through by arroyos, they vary in width up to one half mile and extend for about two miles along the flank of the Chocolate Mountains. One of the principal owners is P. H. Ferguson, 4507½ Esmeralda street, Los Angeles, California.



Part of the Placer Field, Gold Basin. Picacho Peak in Background.
F.J.H.M. Photo.

Much gold is reported to have been taken from these workings in the early days and probably considerable areas remain which could be profitably worked with proper management.

In the same vicinity as the Mesquite Placer, the Erma Mining Company with twelve claims is doing assessment work on some quartz ledges in the schist. The gold occurs in pockets in the ledges which are seldom over three feet wide. These men are also doing some placer work.

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*The Bay Horse was a Lode Claim. The data refers to the adjoining placer claims.

No placering is reported to have been carried on in the region north of the Chocolate Mountains. Washes of considerable extent occur in that region and the possibilties look almost as favorable as they do to the south.

A few prospects of gold and copper-bearing ore are reported in Hodge's Mountains west of Rannels.

COPPER.

This material is shown by surface stains to be widely disseminated through a considerable area 3 miles southeast of Picacho village. Some drilling has been done here, without satisfactory results. At present Wm. D. Sibley and T. A. Ashby, of Picacho, hold a number of claims on this ground and are carrying on assessment work.

IRON.

A deposit of iron oxide, said to carry 50 to 60 per cent of metal, lies about 3 miles northeast of Mammoth Station at the foot of the Chocolate Mountains.

NICKEL.

This metal has been found on the south slope of Coyote Mountain by W. H. Trenchard, of San Diego, who has located a claim upon it. The ore is chiefly Garnierite, a nickel, magnesium silicate. The extent of the deposit has not been ascertained.

SILVER AND LEAD.

Silver occurs sparingly in connection with lead, 1 mile south of the Colorado River, 5 miles east of Picacho. This ore is lead carbonate and galena in small veins and pockets. Some of it has yielded up to 90 ounces of silver. Wm. Swain, of Picacho, holds some claims there. The principal one, called Mayflower, has a 90-foot shaft.

Located on the south side of a cove in the northern part of Barren Mountain is the old Paymaster silver mine. It would probably be located somewhere in the south half of Sec. 17, T. 11 S., R. 21 E., were the land subdivided. The claims were located about the year 1867 and worked for superficial chlorides. Supplies were brought in from San Francisco by boats which came up the Colorado River and landed near the mouth of Arroyo Seco to the northeast.

Water was pumped from the Colorado River by a plant located on Milpitas Wash near the mouth of Arroyo Seco.

At about the 400-foot level the rich ore had been worked out, and the silver values in the galena being low, the property was abandoned by the original owners. No work has been done since about 1880.

Late prospecting has shown that large bodies of galena, containing low silver values remain. The ore body is about 42 feet wide at the bottom of the old workings. An assay of ore, taken from average samples across the ore body, is as follows:

Assay by the El Paso Smelting Company, of El Paso, Texas, for Mr. J. H. Lightfoot, of Blythe City.

Gold,	Trace.
Silver,	6.2 oz. per ton.
Lead,	73.3 per cent.
Copper,	.0
Insoluble,	7.2 per cent.
Iron,	.5 per cent.
Zinc,	0
Sulphur,	11.0 per cent.

The ore is said to lie along the contact of schist and granite and the ore body strikes about N. 45° E., and dips at an angle of about 75.° It is said that two 400-foot shafts were sunk at a distance of about 1,000 feet apart on the ore shoot, and 200 or 300 feet of stoping done in each shaft. In its days of production there was a stamp mill on the property, which was moved away. Three mining claims are at present held on this property by Robert de Luce, of Dome, Arizona, and William D. Hickey, of Neighbors, California. The claims are called El Tesoro, El Banquero, and Plata Real.

MARBLE.

Bulletin 38, page 107.

The chief deposits of this material in Imperial County are in Coyote Mountain, T. 15 S., R. 10 E. This mountain is largely formed of crystalline limestone but not all of it is fit for marble. Here valuable deposits, within 6 miles of the San Diego and Arizona Railroad, now under construction, are owned and controlled by the Golden State Mining and Marble Company, 309 Watts Building, San Diego, C. A. Walker, president; H. H. Sparks, secretary.

This company owns fourteen deposits, each deposit being of different grade and color. Several have the grade and texture of famous mported marbles.

The Creole group consists of four claims of 20 acres each, covering an outcrop of marble about 4,500 feet long and averaging 600 feet wide. All of the development has been done on Creole claim No. 1. Here are three distinct strata of marble. The first is deep blue-black with a hardness of 3½, free from quartz, chert, or other impurity. t is of uniform color, free from holes or blemishes and is impervious o moisture so that it can not be stained even by red ink. The quarry will produce blocks of large size even at the surface. This is suitable or borders, exteriors and pillars and is probably well suited for monuments.

The second stratum on the Creole group is cream pink in color, with occasional blotches of red and black lines which, in the translucent marble, look like the so-called moss in an agate. This marble somewhat resembles the Italian Paonazza. It has a hardness of 3½, is exceedingly tough and free from impurities, takes a high polish and has the desirable quality of translucency when lights are placed behind a slab. This stone also resists stains of ink or oil.

Outcrops of Creole Marble, Coyote Mountain. F.J.H.M. Photo.

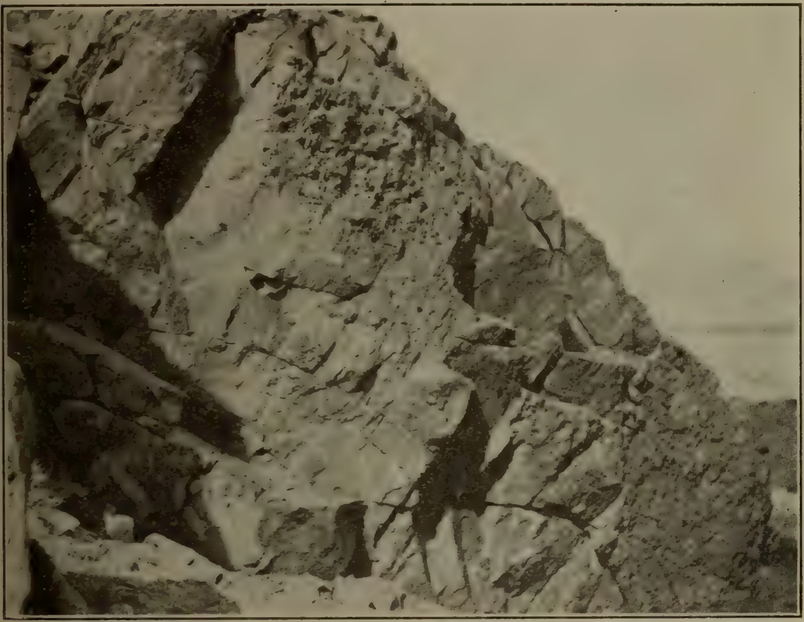
The third deposit of the Creole group is white with a bright green thread line. So far as known, this marble is in small blocks and suitable only for small borders or tiling.

About 2½ miles southerly from the above group is a deposit of marble varying in width from 30 to 400 feet and about 3,000 feet in length.

One end is mottled black and white marble, the color is distinctive. This deposit is solid at the surface. It takes a fine polish and does not show any strings or blemishes. It is suitable for corridors and for interior decoration.

About 600 feet on the other end of this deposit, the marble is very fine grained, and is highly colored in red, yellow, white, purple and blue. In one opening the stone is banded like agate in blue, red and yellow. This marble is over 3½ in hardness, grained like wood and takes a high polish, showing the colors of the African Numidian, as well as lighter and darker tints not seen in that stone.

Near the above deposit the company owns one claim, containing 20 acres of boulders, which appear to be concretions remaining from some overlying formation which has disappeared. The stone is not quite as hard as the ordinary marble, but takes a smooth, glossy finish and shows a great variety of color, including pink, cream, red, yellow, orange and purple, with dashes of green and slender black lines, brecciating the entire mass. This marble is of the Sienna type, but more beautiful and though it can not be obtained in large pieces, it can be used in tiling, soda fountains, knobs and handles for plumbing work, fancy articles and curios.



Creole Marble, Bored by Marine Mollusks. F.J.H.M. Photo.

On the east end of the mountain and about one mile southeast of the above named quarries, this company owns a deposit of blue marble, closely resembling the Esperanza of Vermont. It is fine grained and hard, and is suitable for almost any work to which marble may be put, being especially adapted for monuments. Large blocks of uniform color are ready for shipment.

At the west end of the Coyote Mountain range is a deposit of marble, about one half of which is pure white and as translucent as opal. The other half is a peculiar marble, of lavender tint, without markings of any kind, and can be matched from any part of the quarry. Very little development work has been done here.

This company has erected buildings and ordered machinery for a plant at National City, on the line of the San Diego and Arizona Railroad for the exclusive cutting and finishing of this marble. One carload was shipped on the San Diego and Arizona Railroad last year via El Centro and Los Angeles, and 5 more carloads will be shipped during the coming year to the National City plant.

R. G. Fritz of San Diego also owns eight claims of marble in Coyote Mountain.

CRUSHED STONE, GRAVEL AND SAND.

These building materials are at present brought to the valley chiefly from Riverside County in the vicinity of Whitewater Pass. As the valley cities increase, their demand for such material will lead to the establishment of local plants, since there is an abundance of raw material on the margin of the valley.

LIME AND CEMENT.

On the south slope of the Coyote Mountain and at a point 3½ miles southwest of Coyote Wells are great deposits of limestone.

These deposits are from 3 to 5 miles distant from the survey of the San Diego and Arizona Railroad, and could be easily reached by spurs from that line. About a quarter of a mile from one of the largest deposits is a deposit of blue clay, averaging 70 feet in thickness and covering more than 300 acres of land.

The fact that this limestone carries little or no magnesia makes it ideal for cement manufacture as even a small content of magnesium is undesirable in high grade cement.

An analysis of a sample from Coyote Mountain by F. Salathé is here given:

Calcium carbonate	96.6
Magnesium carbonate	1.7
Silica	Trace
Alumina and iron sesquioxide	.9
Calcium sulphate	.5
Totals	99.7

The raw materials for Portland cement are very abundant on the west side of the Imperial Valley in great deposits of Tertiary clay and crystalline limestone, which are close together, and will soon be within reach of transportation. As the population of the valley increases, there will be a great demand for Portland cement for the lining of irrigation ditches and the local material will doubtless form the basis of a large manufacturing plant.

BRICK.

At various times and at various places in the Imperial Valley, local brickyards have been established and operated for a short time. These now have all been superseded by the Simons Brick Company, main office, 125 West Third street, Los Angeles. Joseph Simons is president and Walter R. Simons, secretary. This company operates at El Centro, about one mile south of the station, a plant for the manufacture of common brick and hollow tile, equipped with two stiff mud and brick machines. The clay used is the local silt of the valley, which is very fine and sticky, requiring much power to work it. This deposit continues unchanged to a depth of 1,500 feet, as shown by local borings, but varies slightly in texture and the proportion of sand present, the variations in composition occurring every 3 or 4 feet. This variation enables the brick maker to mingle layers of different qualities and form a brick mixture of suitable character.

Miocene Tertiary Clay. Near Coyote Mountain. F.J.H.M. Photo.

The plant is operated about 3 months in a year, and the production is about 4,000,000 brick and 200,000 hollow tile.

TERTIARY CLAYS.

Clays, many miles in extent and, perhaps, hundreds of feet in thickness, are found on the west margin of the valley toward Carrizo Creek. These clays have never been carefully sampled, but it seems reasonable to assume that, in them, strata will be found, suitable for various purposes.

GYPSUM.

This material, the hydrous calcium sulphate or sulphate of lime, is of much importance in construction as the calcined product, plaster of Paris, is the base of nearly all wall plasters for interior work. It also forms the base of the material known as staff which is so extensively used in the construction of temporary buildings for exposition purposes. Gypsum is also important as a fertilizer in supplying lime and in correcting alkaline soils. In small quantities, it is used in the manufacture of Portland cement to retard its setting.

Miocene Tertiary Clays. East Side of Coyote Mountain. F.J.H.M. Photo.

The gypsum of Imperial County occurs mainly in an immense deposit some three miles in length from southeast to northwest, with an area of some 800 acres, which occupies a valley, among crystalline rocks, in the northwestern edge of the Fish Creek Mountains. This spur from the crystalline ranges of San Diego County, as shown by the geologic map, lies chiefly in townships 13 and 14 south, ranges 9 and 10 east. The gypsum outcrops are in Sections 19, 20, 28 and 29, T. 13 S., R. 9 E. It has not been thoroughly explored by boring to determine its depth but, from the exposure in ravines, its average thickness is estimated at 100 feet. This is claimed by the owners to be the largest deposit of pure gypsum on the Pacific Slope.

The following analysis made by J. O. Handy, of Pittsburg, Pa., is furnished by one of the owners:

Silica	.92
Alumina	.21
Iron protoxide	.14
Lime	32.75
Magnesia	.08
Sulphur trioxide	47.17
Water	18.73

The ownership of this deposit is distributed as follows:

Acres	Location	Owner
120	SE. ¼, SW. ¼; S. ½, SE. ¼; Sec. 19	Bert R. Chaplin, Suisun.
120	SE. ¼, NW. ¼; N. ½, SW. ¼; Sec. 20	S. L. Ward, San Diego.
160	SE. ¼, SW. ¼; SW. ¼, SE. ¼; Sec. 20 NE. ¼, NW. ¼; NW. ¼, NE. ¼; Sec. 29	Walter O. Hamilton, El Centro. L. E. Cooley, El Centro.
80	E. ½, NE. ¼; Sec. 29	W. H. Allen, San Diego.
40	NW. ¼, NW. ¼; Sec. 28	Sam C. Mack, Imperial.
40	SW. ¼, NW. ¼; Sec. 28	Ed H. Houck, Imperial.
80	NE. ¼, NW. ¼; NW. ¼, NE. ¼; Sec. 33	David Chaplin, Suisun. W. L. Gillette, Holtville.
	The above are all patented under the timber and stone act.	
160	NE. ¼, SW. ¼; NW. ¼; SE. ¼; Sec. 28 S. ½, SE. ¼	C. H. Swallow, San Diego.

None of these are patented.

Gypsum Outcrop. Fishcreek Mountain.

This deposit must necessarily become of great importance as soon as it is accessible to transportation. The new line of the San Diego and Arizona Railroad will pass within about 25 miles, and this will be rather too great a distance to haul a product of moderate value. Should the Atchison, Topeka and Santa Fe Railway build its contemplated line near the old highway from San Felipe through Carrizo Creek, the problem will be in a large measure solved.

Situated on the south slope of the Coyote Mountain range is another deposit of gypsum covering the better part of 10 acres. It is exposed over most of this area, has an average depth of 8 feet, and is said to show by measurements about 84,000 tons in sight, with a continuation under the overcap that can not be determined. The quality is said to be the same as that of the larger deposit to the north. This deposit lies about 3 miles northwest of Coyote wells and could be easily worked.

Gypsum Outcrop. Fishcreek Mountain.

GEMS.

The gem deposits so abundant in San Diego County are not found in Imperial County. Although pegmatite dikes occur at many points in the metamorphic rocks they do not contain the gem bearing veins. Further, the garnetiferous limestones of the Jacumba region do not extend east of the San Diego border.

A few peridots of good quality have been reported from the gravels of the Picacho region. On the slopes of Signal Mountain just across the Mexican boundary a few small turquoise have been found. From the region along the San Diego border some small diamonds are reported but this has not been confirmed.

PETROLEUM.

This important fuel has been sought by boring on the west side of Imperial Valley, but without result.

While Miocene beds are present in this valley it would appear that the conditions under which they were deposited were not specially favorable to oil formation.

The principal well was the Yuha, Sec. 32, T. 16 S., R. 11 E., drilled by the Yuha Oil Company, Chas. Swallow, of San Diego, secretary-treasurer. It reached a depth of 1,363 feet, but without result. Another well was the Mesquite, about 850 feet deep, in Sec. 27, T. 12 S., R. 10 E. This brought a supply of flowing water.

The Barrett well drilled near Carrizo Creek, to a depth of 1,100 feet, was also unsuccessful.

SALT.

Bull. 24.

An extensive deposit of salt was formerly worked near Salton, Riverside County, and if the Salton Sea should again become dry, salt may be found in this basin, within Imperial County.

NITRE.

Bull. 24.

Some years ago some claims were located near Volcano Station on deposits supposed to contain Nitre, but it does not appear that anything more important than traces of this material were discovered.

SULPHUR.

There is a small exposure of this mineral on the east slope of Coyote Mountain. A claim has been located by Chas. Swallow of San Diego.

Desert Springs and Wells.

The following list is taken from U. S. G. S. Water Supply Paper No. 224 by W. C. Mendenhall from data of G. E. Bailey.

"*Soda Springs.*—These are about 15 miles southeast of Fish Springs, on the road from Mecca down the west side of the Colorado Desert. The water is so salt as to be scarcely potable and near by are other springs whose water is entirely undrinkable. Soda Springs are at the base of a low barren knoll, one-half to three-quarters of a mile south of Clay Point, marked by a government bench mark, around which the road turns west on the way from Mecca to Seventeen Palms Springs. The road from Clay Point south toward Harper Well is very little traveled and is difficult to find.

"*Fish Springs.*—Fish Springs (230 feet below sea level), in 1908 submerged to a depth of about 25 feet beneath Salton sea, are a group of strong natural springs whose aggregate yield is several miner's inches. The waters are tepid and slightly saline, but of sufficiently good quality to be used by men or animals without injurious effects. Before their submergence, these springs were especially important to travelers because they were at the southernmost point at which water of fair quality can be procured in abundance along the west side of the desert until Harper (Mesquite) Well is reached. They will emerge again as the lake shrinks by evaporation, and when the lake water has become too saline for use they will again become important. Their position is indicated by a prominent rocky point which stands out in a desert about a mile east of the Santa Rosa Mountains, and which is conspicuous not only because of its position but because of the distinct water line that encircles it 10 to 15 feet below its summit. This point is about 2 miles northeast of the springs.

"*Frinks Springs.*—These are about 6 miles northwest of Frinks Station, on the Southern Pacific Railroad. They are on one of the old wagon roads from San Bernardino to Yuma, near the old beach line that stands about 40 feet above sea level in the Colorado Desert. The water is of good quality and in fair quantity.

"*McCain Springs.*—These springs are about 5 miles somewhat east of south of Clay Point, mentioned in the description of Soda Springs. They are in the center of a broad wash, locally called Arroyo Grande, and are marked by three large sand dunes from a quarter of a mile southwest. The surrounding country is traversed by numerous gulches from 6 to 20 feet in depth and often difficult to cross. The springs, which are well below sea level, have built up a small mound in the bed of the wash. The water appears to be charged with carbon-dioxide gas and is fairly palatable.

"*Harper* (or Mesquite) *Well.*—Near the junction of Carrizo and San Felipe creeks an attempt was made some years ago to develop oil. No oil was found, but at a depth of about 300 feet a flow of good water was obtained. The site of the well is plainly marked by the derrick, which can be seen for a long distance across the plain. There is an abundance of mesquite timber in the vicinity.

"*Kane Spring.*—This is 6 miles east of Harper Well, on top of a low knoll. It is surrounded by cane, salt grass, and arrow weed. The water is full of soda and is very poor, being hardly fit for use.

"*Coyote Well.*—This well is about 375 feet above sea level, on the main stage road from Mountain Springs to Dixieland. The old Coyote well was a mere pit curbed up with planks. A new well, standing about 100 feet from the old one, was fitted up with a pump. The water is rather alkaline, but improves after the well has been used for some time.

"*Yuha Springs.*—These springs are located in a wash near the corner of sections 5, 6, 7, and 8, about 5 miles southeast of Coyote well and a mile southwest of the derrick at the Yuha oil well. The stage road from San Diego to El Centro passes about 2 miles north of the springs. The water is impregnated with alkaline matter, but when used continuously is not unpleasant or harmful. In 1905 there was a trough and pump at the springs.

"*Sunset Springs.*—These springs, which have long been known, are about 13 miles south of east from Brawley, below the old beach which is so prominent a feature about the borders of the Colorado Desert. They are of less importance now than before the reclamation of so large a part of the Imperial Valley by irrigation with Colorado River waters."

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1885-6	H. G. Hanks	Gold Mining	6th Report, Part I	80-90
1887	W. A. Goodyear	Petroleum	7th Report	97
1887	W. A. Goodyear	Coal	7th Report	177-178
1888	W. A. Goodyear	Gold Mining	8th Report	512-516
1888	W. A. Goodyear	General Description	8th Report	516-528
1889	W. A. Goodyear	Gold Mining	9th Report	139-154
1890	H. I. Willey	Geologic Map	10th Report	21-22
1890	E. B. Preston	Gold Mining	10th Report	540-544
1890	C. R. Orcutt	Colorado Desert	10th Report	899-919
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1892	W. H. Storms	Gold Mining	11th Report	376-387
1892	E. B. Preston	Salton Lake	11th Report	387-393
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1896	W. H. Storms	Gold Mining	13th Report, Third Biennial	331-347
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1902	E. Hubon		Register of Mines and Minerals, San Diego County.	
1902	G. E. Bailey	Saline Deposits	Bulletin No. 24.	
*1905	Geo. F. Kunz	Gems, Jewelers' Materials and Ornamental Stones	Bulletin No. 37.	
1906	Various	Structural and Industrial Materials	Bulletin No. 38.	
*1908	Various	Copper Resources of California	Bulletin No. 50.	

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*Now on sale.

N. B.—All of the above publications contain references to Imperial County, as they were issued before it was separated from San Diego.

PART VI.

The Counties of

Shasta, Siskiyou, Trinity

By G. CHESTER BROWN, Field Assistant.

INTRODUCTION.

The three counties presented herewith are situated at the extreme north end of the State, and midway between the eastern and western boundary counties. They thus include the upper end of the Sacramento Valley, with its northernmost tributaries, also portions of both the Sierra Nevada Mountains on the east and the Coast Ranges on the west, the two systems forming a junction at Mount Shasta in Siskiyou County. Lassen Peak which has recently been attracting attention by its renewed volcanic eruptions is in southeastern Shasta County.

The drainage systems of western Siskiyou and Trinity counties are tributary to the Klamath and Trinity rivers which flow direct to the Pacific Ocean. This western drainage area is the only district in California where hydraulic mining is still active on any considerable scale, because of the silt question not affecting any navigable streams.

Though the central part of this section of the State is traversed north and south by a transcontinental railroad line, the greatest drawback to the development of the three counties in question is lack of transportation facilities. This is particularly true of the distinctly mineral areas, in the rugged, western mountains. In addition to the mineral output, lumbering and stock raising are important industries.

Acknowledgment is here made of assistance rendered by the various owners and operatives of properties, both during the field work and in the subsequent preparation of this report.

SHASTA COUNTY.

Field Work in November, 1913.

INTRODUCTION.

Shasta County, noted since 1896 for its copper resources, has an area of 4050 square miles, and lies in the mountainous regions at the head of the Sacramento Valley. It is bounded on the north by Siskiyou, on the east by Lassen, on the south by Plumas and Tehama, and on the west by Trinity County, and derived its name from Mount Shasta, which, when the county was organized, stood within its limits. In 1852, when Siskiyou County was created, it was made to take in that portion of Shasta which contained this mountain, thereby depriving the county's name of its significance and fitness.

The western border of the county is along the Trinity Range summit, and the county reaches eastward high up the slope of the Sierra Nevada Range, which bears westward and merges with the Coast Range in Shasta and Siskiyou counties. Short irregular ranges cover the greater part of the county between the main ranges to the east and west.

In the southeastern corner is Lassen Peak, an old volcanic cone, which has exhibited true volcanic activity since May 30, 1914. In the bowl of the much eroded old crater a series of steam explosions have opened a new vent, and from it stones have been thrown over an area more than one half mile in diameter, and ejected volcanic ash has been wind-borne in sufficient quantities to make a perceptible deposit at a distance of fifteen to twenty miles. No freshly molten lava has been seen and no heat has been noticeable except that of escaping steam. Sulphur fumes and slight sulphur deposits near the vent have been noticed by nearly all observers. On June 28, 1914, the new crater was estimated to have a length of 400 feet. (See photos No. 1 and No. 2.)

"A heavy eruption took place on June 14th, and two new craters opened up a mile from the main hole. A shower of ash and stones fell from the craters and the smoke rose to a height of 5000 feet." (Report of J. M. Stark, United States Forest Service Lookout on Mount Turner.)

That volcanic activity is not yet extinct in the Lassen Peak district is shown by the presence of numerous solfataras and hot springs. At Bumpass' Hell, near the southern base of the peak, there are boiling mud pools and occurrences of vigorous solfataric action. Near by, at the head of Mill Creek, the sulphur deposited by such action is so abundant that attempts have been made to mine it.

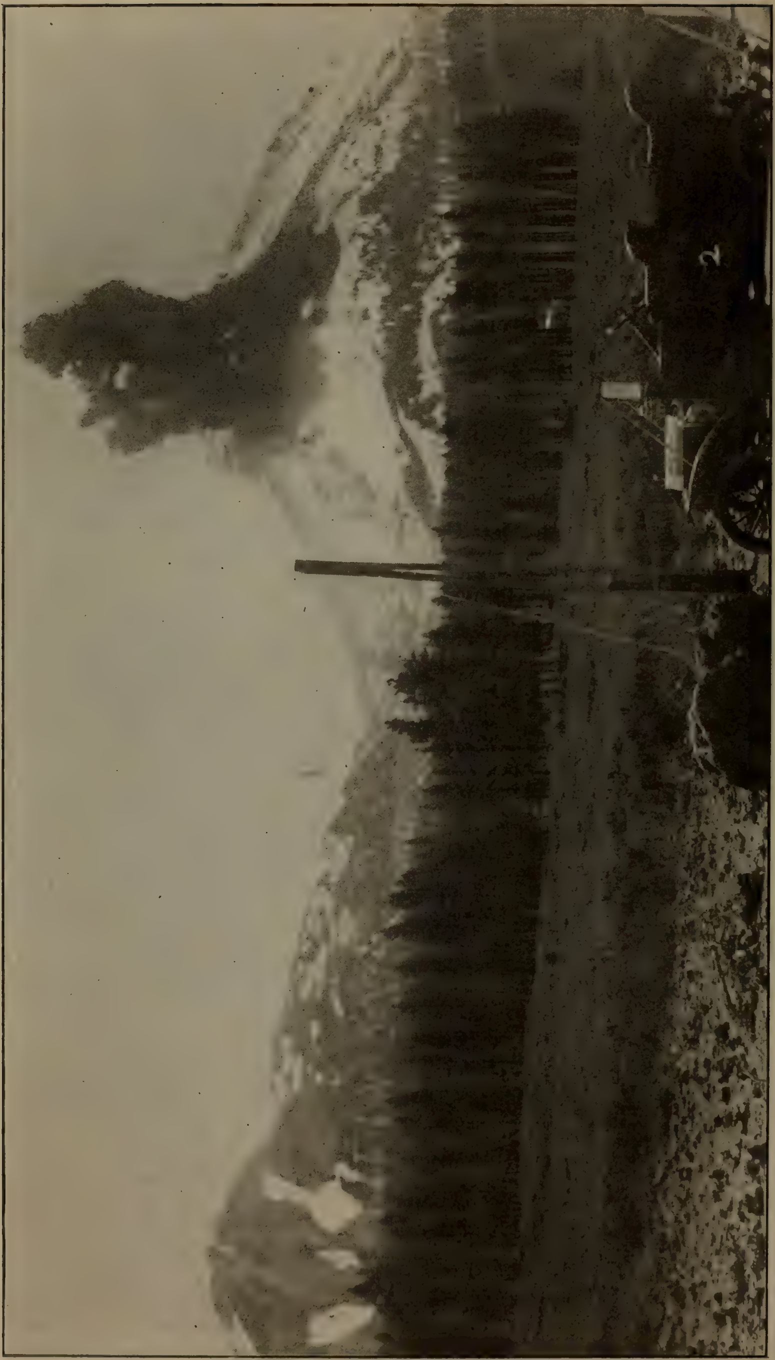

Photo No. 1. Lassen Peak, eruption June 14, 1914, at 9:45 a.m.

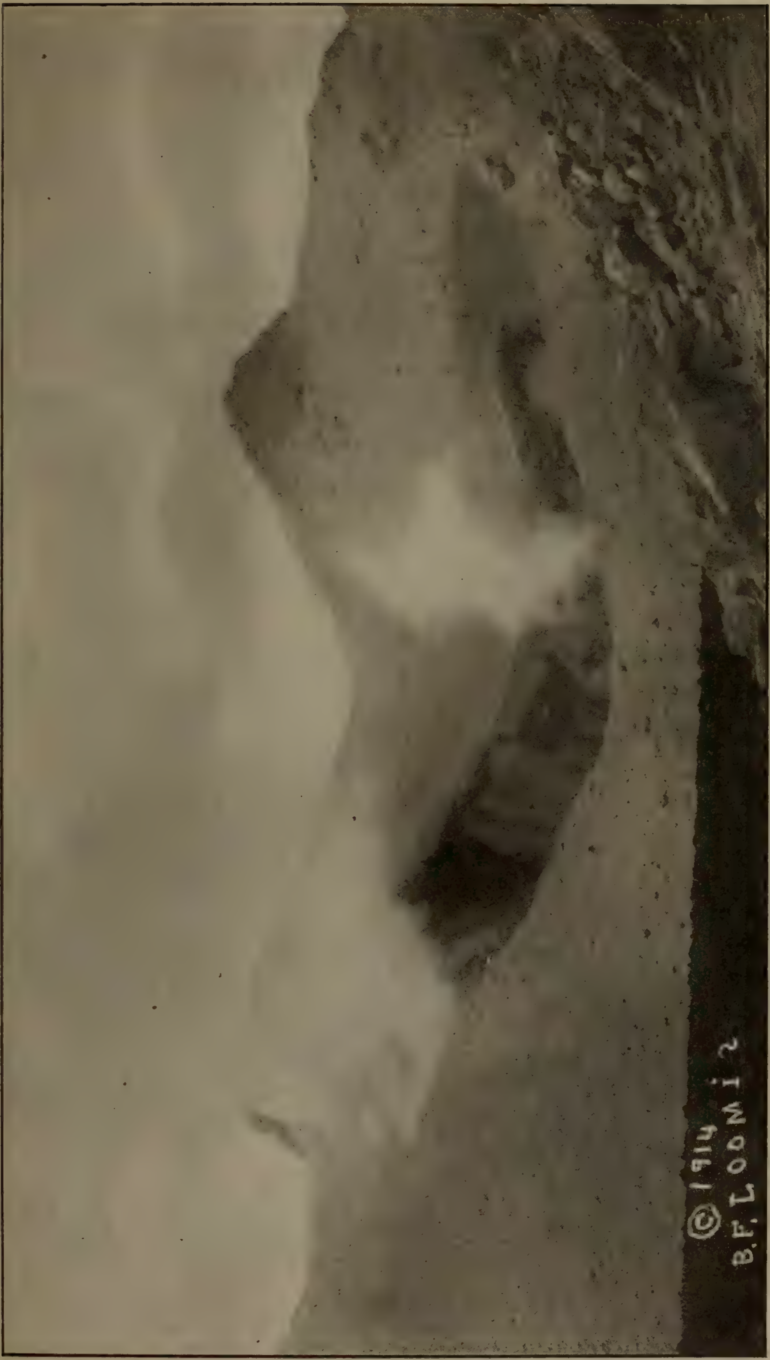

Photo No. 2. Lassen Peak, new crater, 400 feet long, June 28, 1914.

Lassen Peak has four distinct summits, the highest having an elevation of 10,527 feet. During a period of activity a few hundred years ago the lava from this mountain blanketed the eastern portion of Shasta County as far as the Sacramento River.*

Water Resources. Shasta County has a splendid water supply. The rainfall, occurring chiefly in the winter, exceeds forty inches as a rule, and the snows of the higher ranges maintain the streams throughout the summer months.

The Sacramento, McCloud and Pit, the principal rivers, afford valuable power resources. The first two of these rise in the mountains above the northern boundary, while the last has its source in Modoc County. The Sacramento flows southward through the western half of the county in a deep, sinuous and picturesque canyon, crossing the copper belt near the apex of the Sacramento Valley plain. The torrential Pit crosses the axis of the Sierra Range through heavy forests and deep canyons and joins the Sacramento in the midst of the copper belt. The McCloud discharges into the Pit amid the gossan cappings of the copper deposits. Thus there is a general convergence of the important rivers and streams of the county in and through the chief mineral region.

Timber Supply. The timber supply of Shasta County in the higher ranges is excellent, but in other sections adjacent to the mining districts, the supply is generally limited, although on some of the higher ridges yellow pine is found in considerable abundance.

Transportation Facilities. The California and Oregon branch of the Southern Pacific railway system crosses the county and affords direct transportation facilities for the copper belt along the course of the Sacramento River.

The Mountain Copper Company operates a narrow gauge railroad between the mine and Keswick Station. This road is eleven miles long and extremely tortuous in its course, descending a grade of nearly 2000 feet between the mine and its terminus.

The Sacramento and Eastern, a standard gauge railroad owned by the General Electric Company, connects the Bully Hill Mine with Pit station on the Oregon branch of the Southern Pacific Railroad. This road is about fourteen miles long.

The Delta Consolidated railroad, owned by the Delta Consolidated Mining Company, connects Delta, a station on the Oregon branch of the Southern Pacific Railroad, with the mine. This narrow gauge road is seven miles long.

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*Bibl.: Lassen Peak Folio, U. S. Geol. Surv., 1894; University of California, publications in Geography, August 7, 1914; Mining and Scientific Press, Vol. 109, p. 143.

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SHASTA COUNTY—Table of Mineral Production.

Year	Brick		Chrome		Copper		Gold	Lime		Limestone		Mineral water		Pyrites		Silver	Miscellaneous and unapportioned	
	Thousand	Value	Tons	Value	Pounds	Value	Value	Barrels	Value	Tons	Value	Gallons	Value	Tons	Value	Value	Kind	Value
1880	--------	--------	--------	--------	--------	--------	$140,455	--------	--------	--------	--------	--------	--------	--------	--------	$117,907		
1881	--------	--------	--------	--------	--------	--------	350,000	--------	--------	--------	--------	--------	--------	--------	--------	85,000		
1882	--------	--------	--------	--------	--------	--------	300,000	--------	--------	--------	--------	--------	--------	--------	--------	80,000		
1883	--------	--------	--------	--------	--------	--------	210,000	--------	--------	--------	--------	--------	--------	--------	--------	20,000		
1884	--------	--------	--------	--------	--------	--------	320,000	--------	--------	--------	--------	--------	--------	--------	--------	30,000		
1885	--------	--------	--------	--------	--------	--------	417,004	--------	--------	--------	--------	--------	--------	--------	--------	9,223		
1886	--------	--------	--------	--------	--------	--------	699,508	--------	--------	--------	--------	--------	--------	--------	--------	10,647		
1887	--------	--------	--------	--------	--------	--------	627,681	--------	--------	--------	--------	--------	--------	--------	--------	40,204		
1888	--------	--------	--------	--------	--------	--------	600,000	--------	--------	--------	--------	--------	--------	--------	--------	50,000		
1889	--------	--------	--------	--------	--------	--------	415,631	--------	--------	--------	--------	--------	--------	--------	--------	5,396		
1890	--------	--------	--------	--------	--------	--------	420,530	--------	--------	--------	--------	--------	--------	--------	--------	7,279		
1891	--------	--------	--------	--------	--------	--------	554,063	--------	--------	--------	--------	--------	--------	--------	--------	7,432		
1892	--------	--------	--------	--------	--------	--------	574,833	--------	--------	--------	--------	--------	--------	--------	--------	7,977		
1893	--------	--------	--------	--------	--------	--------	500,407	--------	--------	--------	--------	--------	--------	--------	--------	8,577		
1894	--------	--------	1,200	$16,800	--------	--------	617,436	--------	--------	--------	--------	150,000	$75,000	--------	--------	5,032	200 tons iron ore	$1,500
1895	--------	--------	90	1,120	--------	--------	718,696	--------	--------	--------	--------	--------	--------	--------	--------	28,417		
1896	300	$1,500	--------	--------	1,847,087	$184,708	599,209	2,310	$2,541	--------	--------	--------	--------	--------	--------	24,233	Stone industry	1,400
1897	1,200	7,200	--------	--------	13,592,610	1,535,966	569,071	2,100	2,100	9,000	$13,500	--------	--------	--------	--------	96,869		
1898	1,200	7,200	--------	--------	21,442,000	2,465,830	860,180	2,500	3,750	--------	--------	3,000	2,000	--------	--------	171,768		
1899	2,000	14,000	--------	--------	21,835,863	3,565,023	873,719	8,000	10,000	250	375	5,000	1,850	--------	--------	196,213	100 squares, slate Stone industry	800 375
1900	2,000	12,000	140	1,400	25,736,473	4,166,735	733,467	17,850	17,850	1,150	1,150	9,640	5,784	--------	--------	635,640		
1901	3,000	12,000	130	1,950	30,990,781	4,881,048	927,975	21,600	12,960	--------	--------	26,295	7,644	--------	--------	891,994	Stone industry	2,000
1902	2,450	12,250	315	4,275	21,515,887	2,496,731	878,706	18,500	12,500	3,500	3,600	26,295	7,645	3,202	$7,005	306,887		
1903	3,500	17,500	150	2,250	16,453,409	2,171,497	771,242	27,000	10,800	5,400	5,400	40,000	12,000	2,500	5,500	203,991	Stone industry	1,500
1904	3,000	15,000	98	1,470	26,438,145	3,439,974	1,031,429	18,000	10,500	--------	--------	--------	--------	--------	--------	399,660	Unapportioned, 1900-1909	47,723
1905	3,500	14,000	20	300	10,830,865	1,688,614	684,952	10,700	8,000	3,600	3,600	80,000	12,000	--------	--------	167,548		
1906	4,400	22,000	80	1,200	22,477,304	4,338,121	819,144	12,860	8,040	27,000	32,960	--------	--------	32,689	89,895	434,483		
1907	4,500	33,000	260	5,200	27,844,364	5,568,873	791,997	29,222	31,900	30,761	30,761	--------	--------	65,788	197,364	370,211	400 tons iron ore	400
1908	2,000	12,000	280	5,600	34,878,677	4,642,976	1,131,832	11,818	9,100	80,000	80,000	100,000	20,000	93,677	539,553	517,596	Stone industry	25,000
1909	3,500	23,500	205	3,517	58,665,447	7,581,115	1,600,489	8,650	8,000	129,560	134,595	100,000	20,000	449,762	1,349,286	735,460	108 tons iron ore Stone industry	174 4,688
1910	2,425	17,548	680	9,155	44,947,950	5,725,469	1,533,728	16,616	14,114	117,109	117,083	40,000	10,000	31,683	126,692	648,905	579 tons iron ore 1,859 pounds lead	900 83
1911	2,825	20,094	875	13,697	29,539,913	3,692,489	*1,059,881	13,271	10,164	67,924	65,253	25,000	6,250	47,885	151,602	386,991	881 pounds lead	40
1912	1,697	10,195	1,000	8,000	25,249,892	4,166,232	986,803	6,529	3,548	58,022	45,575	23,225	5,646	62,605	174,402	425,382		
1913	360	4,330	280	2,800	27,686,436	4,291,708	1,208,870	8,595	7,030	41,346	35,616	30,000	6,850	72,071	194,409	448,031	47 tons asbestos 19,070 pounds lead Other minerals	1,175 839 10,686
Totals	43,857	$255,317	5,803	$78,734	461,973,103	$66,603,109	$24,528,938	236,121	$182,897	574,622	$569,468	658,455	$192,669	862,762	$2,835,708	$7,574,953	--------	$99,283

*Dredge production included in Stanislaus total.

Totals.

Brick	$255,317
Chrome	78,734
Copper	66,603,109
Gold	24,528,938
Lime	182,897
Limestone	569,468
Mineral water	192,669
Pyrite	2,835,708
Silver	7,574,953
Miscellaneous and unapportioned	99,283
Total to end of 1913	$102,921,076

PHYSICAL
SCIENCES
LIBRARY

Good wagon roads serve the outlying territory from the Southern Pacific Railway.

Mining Industries. Shasta County is identified with the State's early mining activity, this industry, however, being practically confined to the western third of the county, for the eastern half is buried, as a rule, under lava deposits, which effectually hide the minerals that undoubtedly exist.

In that portion of the county west of the Sacramento River, the early placers were rich and extensive, and recent and ancient auriferous gravel deposits remain, affording opportunities for various forms of placer mining, including gold dredging, which is being pursued near Redding.

Hydraulic mining operations are very limited, due to the State débris law, as Shasta is one of the counties affected by this act.

Quartz mining was of slow development, owing to the base character of the ores in most of the districts in which gold-bearing veins were early discovered.

Copper mining has received a setback due to the fume agitations and lawsuits resulting therefrom, yet a solution of this problem is looked for in the near future, as experimental plants are now being erected which should eliminate the trouble. The Mammoth was the only smelter in operation in Shasta County in 1913.

The smelting of iron ore with hydroelectric energy, as practiced at Heroult on the Pit, is focusing the interest of the industrial world. The work has been done on a large and practical scale and results are of a definite nature.

Climatic Conditions. Shasta County has a wide range of climatic conditions, due to the difference in altitude from the valley floor, approximately 500 feet above sea level, to over 10,000 feet. Agriculture is pursued in the valleys and foothills, and a diversity of soil products grown.

Mineral Resources. Its mineral resources consist of gold, silver, copper, zinc, iron, chrome, barite, asbestos, coal, limestone, cement materials, clays, marble, granite, and mineral waters.

Shasta County in 1913 was first in the production of copper, silver and pyrite, third in lead, and sixth in gold. This county ranked fourth in the total mineral production of the State, but exclusive of petroleum, leads all others.

HYDROELECTRIC PLANTS.

The Northern California Power Company Consolidated, organized in 1900, is one of the large power distributing concerns of California. This company has seven generating stations, all in Shasta County, connected with its distributing system, as follows:

	Station capacity, h.p.
Coleman	20,000
Volta	8,500
Kilarc	8,000
Inskip	8,000
South Power House	6,500
South Cow Creek	2,000
Snow Creek	1,600
Total	54,600

The water resources of the Battle Creek drainage, in the main, supply its present requirements. The transmission system is modern in every respect, and some 970 miles of line distribute power throughout Shasta, Tehama, Glenn, and into portions of Trinity, Butte and Colusa counties. A reservoir is being constructed at the head of Burney Creek with a capacity of 30,000 acre feet.

ASBESTOS.

The holdings of Stock & Stevens are being developed in a systematic manner and considerable asbestos of a commercial grade is blocked out. This group, consisting of 1100 acres, is situated in Secs. 1, 2, 3, 4, 33, and 34, T. 37 and 38 N., R. 5 W., in the Trinity Forest Reserve, and about 3 miles east of Sims Station. The elevation varies from 3500 to 6300 feet. Mears Creek runs through the property. The croppings have been opened up in places for a distance of 13,500 feet (see photos Nos. 3 and 4). The country rock is principally serpentine, through which numerous dikes of diorite and gneiss have been thrust. This serpentine carries chrysotile asbestos, both slip and cross fiber, hornblende amianthus (Italian floss), amphibole, and mass fiber of all kinds. One deposit of chrysotile is 270 feet long, 100 feet high, and probably over 400 feet wide on the surface. There are four chrysotile quarries, the cropping faces being 100′ to 500′ in height, with no overburden. One ridge, 7000 feet long, a continuous chrysotile zone, can be worked by means of a steam shovel, from both sides. The average elevation of this ridge is about 6200 feet. A report on this asbestos deposit has been made by H. Leslie Parker (April, 1913). Mr. Parker states that ''on these claims is a wonderful development of actinolite, occurring in the cross fiber fissures, some of which are five inches or more in width and then decreasing in size to ribbon-like seams. The

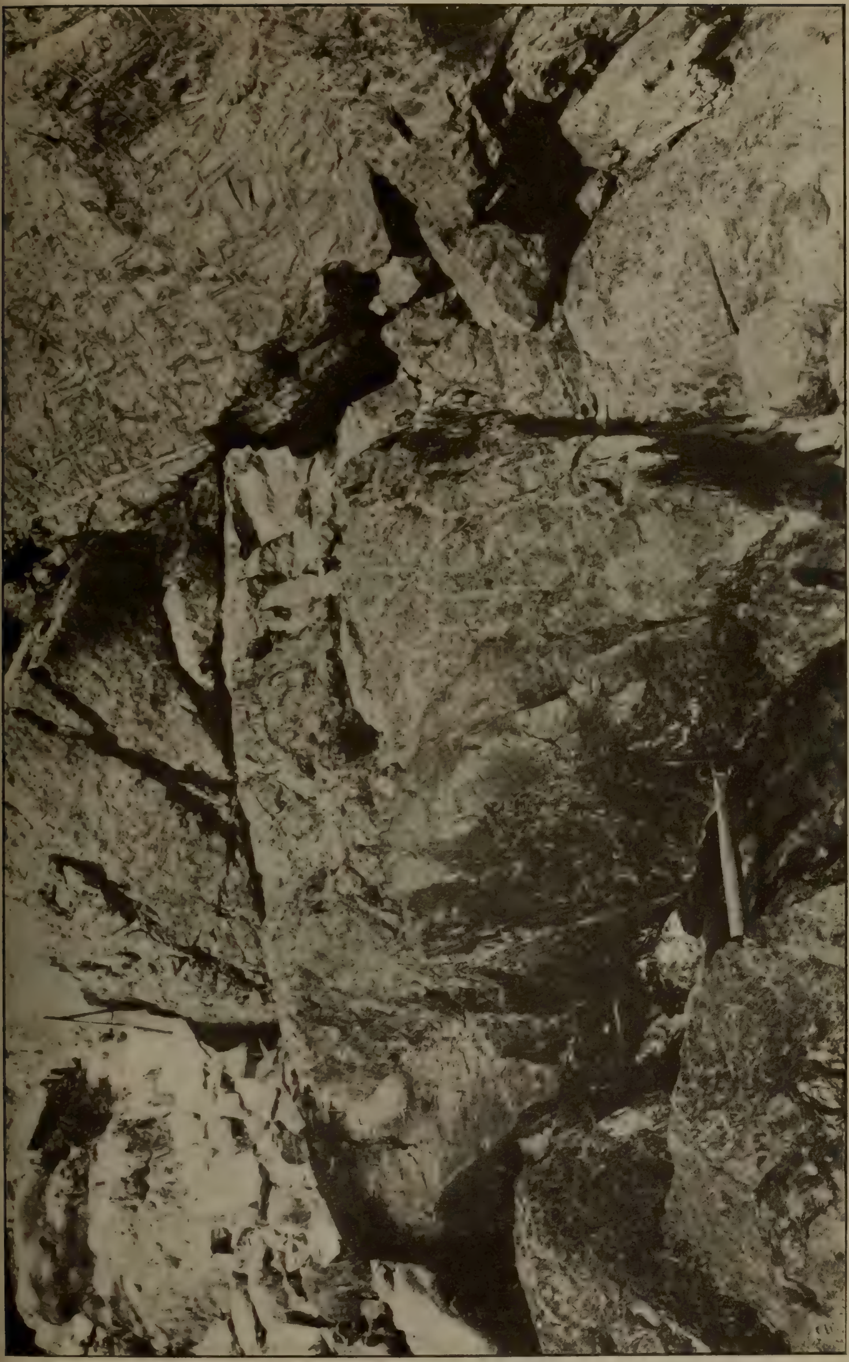


Photo No. 3. Stock & Stevens' asbestos quarry, croppings of chrysotile.

structure of this actinolite is similar to that of cross fiber chrysotile. In the creek bottom is shown cross fiber chrysotile of superior quality and is associated with slip fiber chrysotile, which occurs on the slickensided fractures caused by the rock movements. The claims on the whole are covered with a growth of excellent yellow pine, suitable for all mining, milling and tramway purposes. Hydroelectric power can be cheaply developed on Mears Creek, sufficient for very extensive mining and milling operations.''

Investigations made to determine the quality of this asbestos by the Eaton-Philbrick laboratories show ''that it is of the best quality, and that it is well adapted to any of the many uses to which asbestos has been put. The amphibole especially is recommended as a filter material, as it is easily worked up to the desired degree of fineness, gives a good yield of the finished product, and makes a firm close felt. The chrysotile fiber is of good tensile strength and very flexible. It also makes good filter material if extra long fiber is desired.

Photo No. 4. Stock & Stevens' asbestos quarry, chrysotile deposit.

''Sample marked, Amphibole-White fibrous. Fire test: Fibrous material submitted to heat of furnace up to 2500 degrees F. showed no signs of fusion. Acid test: Prolonged action of hydrochloric and sulphuric acids had no appreciable effect on this material.

"Sample marked, Slip Material. Fire Test: This material was shredded and put into the furnace and heated to 2500 degrees F. No signs of fusion were observed even on the finer fragments. The original material being very brittle in itself it can not be said that this heating had any effect at all."

An excellent exhibit of asbestos from the Stock & Stevens quarry is on display in the State Mining Bureau's museum, San Francisco.

Anaconda, asbestos deposit consisting of 120 acres, is located in Sec. 6, T. 37 N., R. 4 W., about 4 miles north of Sims Station. It is owned by the Pacific Coast Asbestos Company, A. Boldeman, president; office, Oakland. There are seven small veins on the claims, having an average width of 2 feet. Strike is north and south, dip 50° E. The asbestos occurs between a slate hanging-wall and a granite footwall. Development work consists of several open cuts. Idle.

D. E. Miles, 1515 Lafayette street, Alameda, reports asbestos on his land in Sec. 36, T. 38 N., R. 5 W., about 5 miles northwest of Sims Station. No development work has been done to prove the extent of the deposit.

CHROME.

Prim & Dougherty own three chromite claims in Secs. 13 and 24, T. 37 N., R. 5 W., near Sims Station. This chrome belt has been opened up for a length of over 1000 feet. The ore is lustrous black, carrying a high percentage of chromic oxide; it lies in serpentine, in lenticular form. The workings consist of short tunnels, and a 30-foot shaft with 8 feet of ore on the bottom. About 1500 tons of ore extracted from the original discovery on the north of Shotgun Creek. The chromite is shipped to Colorado, Montana and Arizona, and has been used for furnace bottoms at the Bully Hill and Keswick copper smelters. Prim & Dougherty own another claim in Sec. 22, T. 37 N., R. 5 W., on which very little development work has been done and from which no ore has been shipped.

Bibl.: Bull. No. 38, pp. 270, 271, 362.

Little Castle Creek in Sec. 2, T. 38 N., R. 4 W., near the boundary line between Shasta and Siskiyou counties. Owner, L. H. Brown, of Dunsmuir. Holdings consist of 80 acres, located in 1906. Deposit worked by open cuts. Equipment consists of a short tramway and dwelling. Production to end of 1913, about 2400 tons. Four men employed.

Holden et al. of Lamoine own eight claims in Sec. 22, T. 37 N., R. 5 W. Only a small amount of development done, so prospective value can not be determined.

CLAY PRODUCTS.

The Sacramento River Valley bottom, below the mountains, contains extensive clay banks, and on the higher table lands debris accumulation has in places formed clay deposits.

Alata Lime and Brick Company, formerly known as Coleman & Hill, owns the clay bank in Block 29, Redding Grant, about 1¼ miles south of Redding, in the Sacramento River bottom. The clay is 6 feet thick, the upper 4 feet being plastic, which grades into and rests upon a bed of sand, underlaid in turn by gravel; color is tawny. In former years a great many bricks of good quality were burned in this yard.

Bibl.: Bull. No. 38, p. 256.

Holt & Gregg of Redding own a clay deposit in Sec. 17, T. 30 N., R. 4 W., in the town of Anderson. The holdings consist of 200 acres, patented. Another deposit owned by this firm is 2 miles north of Anderson, near the railroad. This clay bed is 15 feet thick and worked by means of open cuts. Equipment for making bricks consists of grinding mill, brick kiln of a capacity of 40,000 bricks in seven hours, cars, etc. The stack is 120 feet high, with 12 feet diameter at base and 8 feet at the top. Cost about $4.50 per thousand to manufacture the brick, which are used for buildings in Redding and other towns in the Sacramento Valley. Fifteen men employed at present. Plant operated upon demand.

This firm also owns a good deposit of fire clay in Sec. 34, T. 34 N., R. 5 W. Used in limekilns for lining.

Bibl.: Bull. No. 38, p. 257.

R. L. Reading owns an extensive clay deposit in the Reading Homestead, east of Cottonwood. This deposit, on the Sacramento River, is 1 mile long and ¼ of a mile wide. The clay is 30 feet thick, capped by 15 feet of gravel. It has not been developed.

Southern Pacific Railway Company owns a clay bed in Sec. 19, T. 32 N., R. 4 W. This deposit covers about 40 acres, and is topped with gravel. It is undeveloped.

Redding Brick and Tile Company owns 40 acres, patented, in Sec. 19, T. 31 N., R. 5 W., 3 miles southwest of Redding. Small kiln at Redding. Idle. Operated upon demand.

Bibl.: Bull. No. 38, p. 257.

COAL.

A bed of coal in Sec. 20, T. 33 N., R. 1 W., M. D. M., has been prospected to a limited extent by M. Kincaid, but the quality is poor, due to the presence of slate. The total thickness of this bed is 15 feet and is often traversed by sheets of slate and clay. It is of late origin geologically speaking, and the dip is practically horizontal. It would not pay to work. Coal croppings are found in other localities near this section, especially on Secs. 3, 7, 8, and 21, T. 33 N., R. 1 W., and also on Sec. 12, T. 33 N., R. 2 W. Very little work has been done and no coal has yet been found that could be mined at a profit.

Bibl.: Reports VII, pp. 190, 191; XI, p. 29.

A body of coal-bearing strata of recent origin is noted in the eastern part of Shasta County, among the western foothills of the Sierra Nevadas, about T. 37 N., R. 1 E., M. D. M. This deposit, covering several townships, consists of strata of soft and unaltered shales and sandstones, having a thickness of about 150 feet, and are spread out unconformably over the upturned edges of the metamorphic gold-bearing slates which form so large a part of the mass of the Sierras.

COPPER.

Description of copper belt. (Extract from Bulletin No. 50.) The crescent-shaped copper belt of Shasta County has a length of approximately 30 miles, and a width of from ½ to 4 miles. The city of Redding, near its western end, is a little south of the chord of the arc described by the belt, while Iron Mountain and the Furnaceville district are the western and eastern ends, respectively, of the horn. The ore deposits occur as disconnected masses, or groups of vein formations, forming individual lodes and districts, and not as a continuous fissure system. These groups of deposits vary both in form of occurrence and in mineralization, being massive, lenticular beds of sulphides on the west, while the eastern half of the belt consists of irregular vein systems, the entire length being marked by massive exposures of gossan which cap its mineralized formations. These croppings of iron oxide and sulphide stand out boldly on the elevations, especially on Iron Mountain, the westerly end of the copper belt. Southerly from Iron Mountain only two or three known copper deposits occur, widely separated, the mineral formations of the belt being succeeded through the adjacent regions by gold quartz veins.

The belt intersects the Sacramento River in Sec. 36, T. 34 N., R. 5 W., M. D. M., at the point where it receives the Pit, and for 10 miles eastward it exhibits its gossan croppings on both sides of the latter stream, being bolder, however, on the north side. The McCloud River empties in the Pit about 4 miles east of the Sacramento, thus terminating in the midst of the copper belt. The Pit enters the belt farther eastward, and many of the tributaries to this stream and the Sacramento cross it; numerous gulches diminish its apparent continuity, the gossans here and there having been eroded away or covered by surface wash.

The ores all carry gold and silver, with a low percentage of the baser metals, zinc, antimony, lead, etc.; the values as a rule are higher in the central and eastern districts of the belt than in the larger ore bodies developed to the west. Many of the important copper properties were originally worked for their gold and silver values remaining in the decomposed portions of the deposits near the surface above the copper sulphides which are now being developed.

Fluxing materials are plentiful and easily accessible, due to the quartz districts adjacent to and the large lime deposits in and near the copper belt.

An ample supply of wood and timber, abundance of water, suitable smelter sites, transportation facilities, and good climatic conditions, present many favorable features for copper mining and smelting.

The Mountain Copper, Mammoth, Bully Hill, Balaklala and Afterthought are the noted copper mines. Smelters have been erected and operated by these companies, but only one, the Mammoth, was in operation in 1913. The Mountain Copper plant has been dismantled and the ore is now shipped to their smelter near Martinez.

Outline of the Geology of the Copper Belt. (Extract from Bulletin No. 50.) The oldest sedimentary rocks are those of the Devonian age, which are found especially along the western districts extending northward from Clear Creek to the Big Backbone, and also east of the Sacramento River, in the vicinity of Baird. These rocks are metamorphic and include the limestones and their underlying slates, or schists, found near Kennett, Copley and Horsetown.

The Carboniferous represents the next succeeding period among the sedimentary rocks, and includes both limestones and slates. This period is represented by the conspicuous limestone belt east of the McCloud River, near Baird, and extending in a southerly direction beyond the Pit River.

The next oldest sedimentary rocks, succeeding the Carboniferous period, is represented by those of the Triassic age, which occur still farther east in the vicinity of Squaw Creek and Bear Mountain. They consist, for the most part, of silicious slates, overlain in some places by limestone which is usually very fossiliferous. The limestones to the north and east of Bully Hill belong to the Triassic period.

The igneous rocks are vitally connected with the ore deposits of the copper belt. The geological age to which they seem referable can not be younger than the Cretaceous nor older than the Triassic. Most of the rocks are of acid character, being high in the percentage of silica. In the main, igneous rocks seem to underlie all of the sedimentary rocks. Rhyolite, trachyte and andesite are names properly given to surface flows of volcanic rocks, and such flows occur throughout the copper districts, associated with tuffs and breccias of a similar age and character. These volcanic rocks, including both the flows and the fragmental rocks, are especially seen near Iron Mountain, the Shasta King, Bully Hill and Afterthought mines. Porphyry and diabase dikes occur in the belt also, the latter accompanying the iron ores. The copper belt, in the main structural features, consists of a number of north and south folds, or belts, of sedimentary rocks which belong to a succession of periods, and beneath which extend the rocks of the great granitic intrusions. Dike rocks have been found penetrating both the eruptives and the overlying sedimentary rocks.

ORE DEPOSITS.

The deposits of copper belonging to the Shasta belt are vastly different from the usual quartz veins as ordinarily understood, both as to their forms as ore bodies and as to their origin. These ore bodies, as a rule, are of great size, consisting of large bodies of massive sulphides occurring along the borders of or within areas of eruptive rocks. They are not often bounded along the sides by definite walls, though sometimes one wall is in evidence, emphasized as to its extent by a selvage of clay and other similar material showing a certain amount of either lateral or vertical movement. Evidence is lacking to show that such walls have had any connection with the genesis of the ore. The ore bodies fade out by gradual transitions from ore, in which there is more or less waste, to rock in which there is more or less ore, and finally into rock with only a small percentage of disseminated sulphides.

There are three classes of ore deposits within the copper belt. The first of these consists of deposits of magnetic iron (magnetite) with pyrrhotite and pyrite, as represented north of the Pit River, and southeast of Baird, and the largest at the head of Potter Creek. The second class consists of massive deposits of pyrite, chalcopyrite and other sulphides, which form the principal deposits of copper ore lying west of the Sacramento River, and includes the ore bodies of Iron Mountain, Squaw Creek, Backbone Creek, etc. The third class, including vein-like deposits of mixed sulphides, and a relatively large percentage of gold, silver, zinc, antimony, etc., is represented by the ore bodies of Copper City, the Bully Hill, Afterthought, and other mines.

Residual accumulations of metallic oxides often form thin crusts of masses of ''gossan,'' or else only stain the rocks upon which it is deposited. The chief metallic element of the ''gossan'' is iron, though it very often contains a small percentage of copper, and it has often formed an ore of gold and silver, as in the Iron Mountain, Bully Hill and Afterthought mines.

The ''gossan'' at the Iron Mountain consists in many cases of crusts of limonite many feet in thickness, while at the Bully Hill the surface indications are very different, although the term ''gossan'' is likewise applied. Instead of crusts of limonite the surface at the latter is largely covered by broken and stained masses of rock, often light colored, but generally containing some metallic oxides.

COPPER MINES.

Afterthought, formerly known as the Peck, is located in the North Cow Creek mining district, in Secs. 10, 11, 15 and 5, T. 33 N., R. 2 W., M. D. M., in the Shasta Forest Reserve, and in the town of Ingot, which is 24 miles from Redding, the county seat. This group, consisting of 1650 acres, of which 1550 are patented, is owned by the Afterthought Copper Company, formerly known as the Great Western Development Company, S. E. Bretherton, president and manager; T. H. Adams, secretary; J. H. Bull, superintendent; F. L. Wilson, chemist. Home office, Indianapolis, Ind. The Copper Hill and the Afterthought claims hold the larger part of the ore body and are the main producers. The ore body is distinctly a contact deposit in a formation of marked schistose character, which is indicatory of severe metamorphic action, the richest ore being encountered where the greatest movement has taken place in the shales and stratified andesite. The contact is followed to a considerable depth, much of the best ore being mined from the lower levels.

Photo No. 5. Smelter, Afterthought Copper Mine.

There are two parallel veins, the Afterthought and Copper Hill, having a northwest and southeast strike, and a dip of 40° NE. Occurrence and shape of the ore resembles that of the Bully Hill. Workings consist of a main adit 2200 feet in length (nine tunnels in all), six levels, crosscuts, raises, stopes, 536-foot shaft and 230-foot winze, comprising in all several thousand feet of development work. Ore shoots have a length of 400 and a width of 25 feet. The ore is extremely refractory, containing, besides gold, silver and copper, a high percentage of zinc (sphalerite) and barium. The average ore carries 2.81% copper, 11.6% iron, 5.4% lime, 3% zinc, 20.25% sulphur, 18% silica, 5.3% alumina, 7.4% barite, and $4 per ton in gold and silver. Laboratory experiments are being made to endeavor to devise a method of working the high grade zinc ores.

The mine equipment consists of a 30-inch gauge railroad, 1 mile long from the mine to the smelter, Davenport steam locomotives, two 20 h.p. steam and one 30 h.p. electrical hoists, cages, air compressor, drills and all necessary buildings. The smelter plant, 1 mile below the mine in the town of Ingot, 150 tons daily capacity, was constructed in 1904 and operated until 1908, during which time the output averaged $350,000 yearly (see Photo No. 5). This plant consists of two blast furnaces, two hot blast stoves, blowers, pumps, sampling mill, crushers, storage bins, ore yards, shops, dwellings and offices, and one electrical substation, power being obtained from the Northern California Power Company. Company also owns the railroad from Anderson to Bella Vista (old Shasta Lumber Company's road), and supplies are hauled from Bella Vista to the plant, a distance of 12 miles. The cost of operating the smelter is heavy, so that only a high grade of ore can be handled. This property is on the eastern end of the copper belt, and was discovered in 1872 by James Peck, and after passing through several hands was acquired by the present owners in 1903. Worked at one time for gold only, as some of the oxide ore on the surface was very rich. Company claims a considerable tonnage of good ore in sight. During 1913 only five men were employed. Donkey mine adjoins this group on the east.

Bibl.: Bull. No. 50, pp. 102-105.

Arps, in Secs. 20, 21, 28 and 29, T. 34 N., R. 3 W., 1¼ miles north of Copper City, in the Pittsburgh mining district, consists of 250 acres in the Shasta Forest Reserve, adjoining the Copper City claims of the Bully Hill Mining Company. Owners are Arps & Saeltzer. Development work consists of five tunnels, from 350 to 850 feet long, and a 160-foot drift. Ore is base, carrying considerable zinc. Formation similar to the Bully Hill. Some good ore found on the surface. Arps, one of the owners, doing some development work. Prospect.

Bibl.: Bull. No. 50, p. 110.

Balaklala Copper Mine, consisting of 1149 acres, patented, is in the Flat Creek mining district, in Secs. 10, 11, 12, 13, 14, 17, 20 and 21, T. 33 N., R. 6 W., about 3 miles northwest of Coram Station. It is owned by the First National Copper Company, but is operated under the name of the Balaklala Consolidated Copper Company, T. W. Lawson, president; W. A. Kerr, secretary; F. M. Leland, general manager; D. S. Epperly, superintendent. Home office, New York. Property acquired in 1905 from the Western Exploration Company. The mines are located on the south side of Squaw Creek at an elevation of 2400 feet. The country rock is meta-rhyolite; several faults from 2 to 100 feet in width parallel with the strike of the ore bodies. Ore bodies consist of a hard, heavy iron sulphide, carrying chalcopyrite, a little galena, covellite and some gold and silver. Two large separate ore bodies are known, one near Mule Gulch, the other in the vicinity of Windy Camp. The eastern body, near Mule Gulch, was discovered by means of diamond drills and developed through the Weil tunnel, which has a length of 2400 feet. Raises were made through its entire thickness, and drifts run on both sides through the ore and the dimensions were found to be 1200 feet in length (east to west), 300 feet in width (north and south), and from 20 to 40 feet thick. The development work comprises several thousand feet of drifts, three crosscuts from 40 to 400 feet in length, eight levels, eight raises from 40 to 400 feet in height, tunnels and open cuts. Ore is blocked out in 25-foot sections from the Weil tunnel. The other deposit, Mule Gulch, is over 900 feet long and 20 to 60 feet thick. Ore is reported to run: gold .025 oz.; silver .85 oz.; copper 2.46%; silica 23.5%; iron 29.8%. Equipment consists of 16,500 feet of aerial tramway to bring ore from mine to smelter, 3 miles of telephone line, and all equipment necessary to operate a large mine. The smelter plant, some 3 miles from the workings, at Coram, consists of four 18-foot McDougal roasting furnaces, three 55″ x 240″ water jacketed blast furnaces, smelting furnaces, one 17′ x 92′ reverberatory furnace, water plant, sampling mills, three boilers using oil for fuel, generators, offices, etc. Electric power obtained from Northern California Power Company. Daily capacity of smelter 1000 tons; production in 1908 was 3,061 tons. Smelter idle since 1911. Number of men employed at present sixty-five—fifteen in mine and fifty on surface. Total operating cost in 1908 was $5.58 per ton. One of the large copper mines of Shasta County, with over 2,000,000 tons of ore in sight. Hall desulphurizing plant being installed.

Bibl.: Bull. No. 50, pp. 88–94; Reports X, p. 638; XII, p. 245; XIII, p. 61.

Bald Eagle, consisting of 140 acres, in Sec. 10, T. 34 N., R. 3 W., 2 miles north of De La Mar, in the Pittsburg mining district. Claims are in the Shasta Forest Reserve. Owner, J. Gilardy. Ore similar to the Bully Hill. Only small amount of development work done and extent of ore body not determined. Idle at present.

Brushy Canyon, consisting of 160 acres in Sec. 34, T. 34 N., R. 3 W., about 2 miles southeast of Copper City, in the Pittsburgh mining district. Owners, W. Collins et al. A tunnel is in over 300 feet through a black, slaty-shale formation, distorted and sheared by intrusions. Ledge outcrops on the surface. Idle.

Bibl.: Bull. No. 50, p. 102.

Bully Hill, one of the famous copper mines of California, is located in Secs. 15, 16, 21, 22 and 28, T. 34 N., R. 3 W., M. D. M., in the Pittsburgh mining district, near the town of De La Mar, and in the Shasta Forest Reserve. The holdings comprise 450 acres, of which 320 are patented, and include the old Winthrop and Baxter, Bully Hill, Rising Sun and Rising Star groups, all well toward the eastern end of the copper belt. General Electric Company, of Syracuse, New York, owners. Geo. Hanley, superintendent. The Sacramento and Eastern standard gauge railroad, owned by this company, connects the mine with Pit station on the Oregon branch of the Southern Pacific Railroad. This road is about 14 miles long, and handles all necessary freight. The Bully Hill mine lies in meta-rhyolite. The ore is found in veins trending northeast and southwest with almost a vertical dip to the east, width from 4′ to 400′, averaging about 30′. The eastern wall is formed by basalt, and the vein occupies a shear zone. Two main parallel lodes have been exploited. The ore occurs in irregular lenticular bodies, connected by narrow seams of ore, attaining an average width of 45 feet, and a length of 200 feet. In the basalt wall are found ore deposits fully equal to those occurring in the vein. The ore is of a complex and refractory nature, carrying zinc, antimony, copper, gold and silver. Copper oxides are found in the upper levels, changing into copper glance (chalcocite) with depth, and chalcopyrite in the lowest levels.

The mine has been opened by a number of tunnels with extensive drifts, crosscuts, raises, comprising several thousand feet. There are nine levels 100 feet apart, eight raises from 50 to 560 feet in height, and 1100-foot crosscut on the Bully Hill claim. The lowest tunnel (No. 3 level) was run as a crosscut and struck the vein at a distance of 1100 feet, and about 600 feet below the gossan outcrop. At this point a station (100 feet square) was established, extensive hoisting and pumping machinery installed, and a 3-compartment shaft sunk to a depth of 950 feet. No. 3 level is connected by chutes and raises with the upper workings, of which some drifts run along the vein 800 and 1000 feet. This level is connected by railway with the smelter 1 mile distant and the ore handled through it. The mine is timbered by the square set system, the timbers being floated down the Pit River from the timber region to the northeast.

The mine equipment consists of cars, tools, a 2-drum electric hoist, two electrical pumps, shops, compressor plant, and all necessary dwellings.

The smelting plant, daily capacity 400 tons, was installed in 1901, at a cost of $200,000, and consists of one water-jacket furnace (42″ x 120″), two calcining furnaces, five converters for bessemerizing the matte, shops, etc. Idle during 1913. The product of the converters is blister copper about 98% fine, and is shipped to the refinery built by Capt. De La Mar on Kill von Kull, near New York City. As the ore carries considerable zinc, laboratory tests are being made to find a proper method of treatment. During 1913 sixteen men were employed. This mine has the greatest depth below the surface of any copper property in California, and has produced several millions. It was worked as a silver mine in the '60s by H. McDonnell, as the ore on the surface carried high values in this metal. Acquired later by James Sallee, and purchased by Captain De La Mar in 1899 and sold in 1903 to present owners.

Bibl.: Bull. No. 50, pp. 78–84; Report XIII, pp. 61, 62.

Chance, in Sec. 21, T. 34 N., R. 3 W., consists of 80 acres, patented, in the Pittsburgh mining district, about 1 mile north of Copper City. Owner, R. G. Dunn. Ore body, consisting of heavy grayish sulphides, is similar to the Bully Hill. Extent of shoot not determined, as only small amount of development work has been done. Short tunnels. Bully Hill group of claims to the east. Prospect. Idle.

Congress, consists of 120 acres in Sec. 4, T. 33 N., R. 2 W., in the North Cow Creek district, about 2 miles west of Ingot. Owner, H. A. Cook, of Ingot. A series of exploration tunnels aggregating 500 feet have been run, but no great depth below the croppings have been reached. Owner does assessment work only. Prospect

Bibl.: Bull. No. 50, p. 111.

Copley listed under gold.

Crystal Group, consisting of twenty-three claims, is located in Sec. 11, T. 33 N., R. 6 W., in the Flat Creek mining district, adjoining the Balaklala on the north and the Vulcan on the west, and about 3½ miles northwest of Coram. Owners, Crystal Copper Company, W. S. Tyler, president; J. L. McGinnis, secretary. Short tunnels. Idle. Prospect.

Bibl.: Bull. No. 50, p. 113.

De Dallis, consists of 175 acres in Sec. 34, T. 34 N., R. 3 W., in the Pittsburgh mining district, about 1½ miles southeast of Copper City, in the Shasta Reserve. Owners, Ellis et al. Slate foot and quartz-porphyry hanging-walls. Ore body said to be 200 feet long and 8 feet wide. Several hundred feet of development work consisting of 420-foot tunnel and drifts. Three men employed. Prospect.

Bibl.: Bull. No. 50, p. 102.

Donkey, consists of 40 acres, patented, in Sec. 11, T. 33 N., R. 2 W., in the North Cow Creek mining district, about 2 miles northeast of Ingot, and in the Shasta Forest Reserve. Owner, A. J. McKendrick, of Ingot. It is an old property located in 1876 by A. J. Cook, and said to be an extension of the Afterthought lead. The ore occurs in rhyolite, and is a heavy grayish sulphide, carrying a high percentage of zinc, in addition to copper, gold and silver. Development work consists of a 200-foot shaft, 300 feet of drifts, and a 100-foot raise. Equipment consists of electrical hoist, 1500-gallon electrical pump, and dwellings. Western Zinc Company of San Francisco worked the property on a lease for a time and shipped 300 tons of ore to their plant at South San Francisco. Ore very difficult to treat on account of zinc. Property has been a producer. Idle.

Bibl.: Bull. No. 50, pp. 105, 106.

Friday & Lowden, consists of thirteen claims, in Secs. 5 and 6, T. 33 N., R. 5 W., about 3 miles west of Kennett, in the Backbone mining district. Owner, J. R. Lowden et al., of Redding. This group of claims is the first encountered on the copper belt on the north side of Squaw Creek, and is directly east of the gold belt in which the Uncle Sam mine is located. Elevation about 2000 feet. The geological conditions are similar to those found in adjacent territory on the copper belt. Oxide ore carries considerable gold, and the property was worked at one time for this metal. Workings consist of about 1000 feet of tunnels. Idle.

Bibl.: Bull. No. 50, pp. 94, 95.

Giant Consolidated, consists of thirteen claims, in Secs. 19 and 24, T. 33 N., R. 5 and 6 W., about 3 miles northwest of Copley, in the Flat Creek mining district. Owners, W. H. Soderberg et al., of San Francisco. Claims are located on the eastern edge of this part of the copper belt, north of the Jumping Jack. Only slightly developed by a 310-foot tunnel, and some open cuts. Prospect. Idle.

Bibl.: Bull. No. 50, p. 85.

Gold Belt, consists of six claims, in Sec. 4, T. 33 N., R. 2 W., about 2 miles west of Ingot, in the North Cow Creek mining district, and in the Shasta Forest Reserve. Owners, Jones & Tucker, of Ingot. A 50-foot shaft penetrated 6 feet of iron capping, below which a schistose and slaty formation was encountered, carrying copper sulphurets with traces of gold, silver and zinc. Prospect. Idle.

Bibl.: Bull. No. 50, p. 111.

Golinsky Group, formerly known as Little Backbone, under bond to J. Bayhau, is located in Sec. 28, T. 34 N., R. 5 W., about 4 miles west of Kennett, in the Backbone mining district. Owner, B. Golinsky, of Kennett. Holdings consist of 300 acres, patented, adjoining the Mammoth mine on the east. Ore body and formation similar to the Mammoth. Workings consist of several tunnels, one being 800 feet in length, 400 feet of drifts, and one stope. Ore bin and dwellings on the property. Produced $70,000. Five men employed. Some good ore in sight.

Bibl.: Bull. No. 50, p. 111.

Great Verde, formerly known as the Vulcan, is located in Secs. 11 and 12, T. 33 N., R. 6 W., about 7½ miles west of Kennett, in the Flat Creek mining district. Holdings consist of twelve claims (four patented), owned by the Vulcan Mining Company of San Francisco. W. K. Lisle, superintendent. Several tunnels. Some low grade ore in sight. A little prospecting done with a diamond drill. Adjoins the Balaklala on the north. Idle at present. Prospect.

Bibl.: Bull. No. 50, p. 98.

Hartford consists of ten claims, 3 miles north of the mouth of Protem Creek. Owners, Hartford Consolidated Mining Company, W. Gerry, president. Limited amount of sulphide ore. Only developed to a limited extent by 500 feet of tunnels. Lode on the surface 8 feet wide, and can be traced about 100 feet. Surface ores consist of oxides and carbonates of copper. Prospect. Idle.

Bibl.: Bull. No. 50, p. 108.

Indiana and Last Chance consists of four claims, in Sec. 29, T. 33 N., R. 5 W., about ½ mile north of Copley, in the Flat Creek mining district. Owners, Roan & Putney. Workings comprise several hundred feet of tunnels and drifts. Heavy sulphide ore, with some high grade oxides on the surface. Small producer. Two men employed.

Ingersoll, formerly known as the Peerless, is located in Secs. 25 and 36, T. 33 N., R. 6 W., in the Flat Creek mining district, about 2 miles west of Copley. Holdings consist of 300 acres, adjoining the Trinity Copper Company's property. Heavy gossan outcrop similar to the Trinity Copper, on same lead. Workings consist of a 350-foot tunnel on the lode, and a 190-foot crosscut. Idle.

Bibl.: Bull. No. 50, p. 114.

Jumping Jack consists of five claims in Secs. 24 and 25, T. 33 N., R. 6 W., in the Flat Creek mining district, about 3 miles west of Copley. Owner, W. Candrick. Claims on same belt as the Iron Mountain. Only slightly developed by a tunnel 400 feet long; extent of ore body not determined. Prospect. One man working.

Bibl.: Bull. No. 50, p. 85.

Kosh Creek, consists of twelve claims, in Sec. 23, T. 37 N., R. 1 W., several miles north of the copper belt. Owners, W. Murray et al. Ore is a dark basaltic rock, carrying native copper, which occurs in globules and films in the vesicles of the rock. Ore zone said to be 200 feet wide. Slightly developed. Idle. Prospect.

Bibl.: Bull. No. 50, p. 108; Report XIII, p. 63.

Loraine, located in Secs. 7 and 8, T. 33 N., R. 5 W., adjoins the Spread Eagle group on the northeast, and about 4 miles west of Coram Station. Owner, D. Endicott et al. One tunnel 425 feet long on the ore body and several short crosscuts. Idle.

Bibl.: Bull. No. 50, p. 87.

Mammoth Copper Mine, the largest copper producer in California, is located in Secs. 2, 3, 29, 31, 32, and 33, T. 33 and 34 N., R. 5 W., about 4 miles northwest of Kennett. The holdings, consisting of 2500 acres patented, and several claims held by location, are owned by the United States Mining and Smelting Company, but this mine is operated as the Mammoth Copper Mining Company. President, W. G. Sharp; secretary, F. W. Bachelder; general manager, F. W. Metcalf; superintendent of mine, R. E. Hanley; superintendent of smelter, J. H. Kerbin. Home office, Boston, Mass. Elevation at main workings 3000 feet. Formation and character of ore similar to other mines on the western portion of this copper belt. Some of the ore bodies are 800 feet long and 90 feet wide, and are opened up by numerous tunnels, drifts, stopes, etc., aggregating over 60,000 feet of development. The lowest tunnel, the Coleman level, is over 2200 feet long, and serves for hauling the ore from all parts of the workings to the surface, where it is dumped into bins, and then conveyed to the smelter, a distance of four miles, by means of electric cars. In working the mine the top-slicing method is used. After removing the ore from a certain area the empty stope is filled by caving down the roof. The effect of this method is seen on top of the mountain above the workings, where the ground has caved in many places and is crossed by numerous issures.

The greatest depth on the ore bodies is 700 feet. There is a large onnage of low grade ore blocked out. The mine equipment consists of all mechanical devices necessary to operate on a large scale, such as ompressors, sawmill, shops, railways, both electric and steam (at melter), ore bins, dwellings, etc. Nelson, the discoverer of this mine, worked it in a small way for gold, as the gossan carries gold values similar to the Iron Mountain. The smelter at Kennett has a capacity of 2200 tons (see photo No. 6). A bag house has been installed to gather the fumes. The semi-pyritic process of smelting is used, the ore being treated with a low percentage of coke. The matte is treated and refined at Chrome, New Jersey. Smelter is not running at full capacity, as only 1200 tons are being handled at present. About 825 men are employed. Operating cost is very low. The smelting process consists in eliminating the excess of iron in the ore by adding an excess of silica and lime to the charge, so as to obtain a thin slag. It requires one car of coke to three of ore and silica, which are automatically conveyed from the weighing platform to the blast furnaces (five in number) by means of electrical trains. The matte from the furnaces is taken to the converters by means of a 50-ton crane. The converters, made by Allis-Chalmers Company, are 96″ x 150″ and are acid lined. When the five converters are running the first matte is reconcentrated in the blast furnace up to 40%. Matte as low as 18% has been treated.

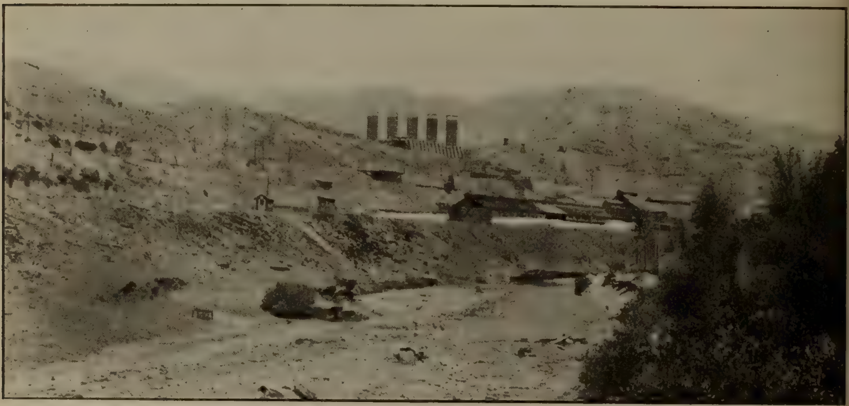


Photo No. 6. Mammoth Smelter; bag house in center.

The bag house, contained in a building 210′ long, 63′ wide and 66′ high, was built in 1910 to remove the arsenic, sulphur and other impurities from the fumes. This house is divided into five sections or towers, each section containing 592 bags, or a total of 2960. The bags, made of woolen, are 34 feet long and 18 inches in diameter, and are set longitudinally. The residue, collected in the bags from the fumes, is in the form of a white powder (arsenic, sulphur, gold), and when shaken from the bags drops into a water hopper and is then removed As no process has as yet been devised for treating this residue, it is stored near the smelter. Some 16 tons obtained daily at the present time. Upon leaving the blast furnaces, these fumes pass through a steel pipe 10 feet in diameter, thence into brick flues, then into fou steel pipes, each 8 feet in diameter, thence into a fan discharge chamber from which they enter steel pipes 4 feet in diameter, arranged in nine sets of five each, and then into the distributing chamber of the bag house.

Bibl.: Bull. No. 50, pp. 95, 97.

Marshall & Walters, consists of 160 acres in Secs. 14 and 15, T. 33 N., R. 6 W., in the Flat Creek mining district, about 4 miles west of Coram Station. Owners, Marshall & Walters, of Redding. Slightly developed by a tunnel 400 feet long. Prospect adjoining the Stowell on the south. Idle.

McClure, consisting of 160 acres, patented, is located in Secs. 9 and 16, T. 34 N., R. 3 W., 1½ miles north of Copper City, in the Pittsburgh mining district, and adjoins the Bully Hill on the northeast. Owners, Mt. Shasta Gold Mines Corporation. Formation and ore body similar to its famous neighbor. The principal development work consists of a crosscut tunnel over 500 feet long, in which some good ore is exposed. Prospect. Two men employed.

Bibl.: Bull. No. 50, p. 110.

Mineral Mountain consists of six claims, on the southwest terminus of the copper belt, in Sec. 13, T. 32 N., R. 6 W., in the Flat Creek mining district, and 3 miles south of Iron Mountain. Owners, D. T. Callahan et al. Three hundred-foot tunnel shows sulphide ore. Surface indications of other ore bodies. Prospect. Idle.

Bibl.: Bull. No. 50, p. 84.

Morris, consists of 120 acres, in Sec. 10, T. 34 N., R. 3 W., in the Pittsburgh mining district, about 2½ miles north of De La Mar, and in the Shasta Forest Reserve. Owner, W. H. Barkhurst, of Redding. Ore similar to Bully Hill. Two tunnels, 400 feet and 80 feet in length. Prospect. One man working.

The Mountain Copper, formerly known as Iron Mountain, is the pioneer copper mine of the Shasta County copper belt. The holdings, consisting of several hundred acres, patented, are located in Secs. 34 and 35, T. 33 N., R. 6 W., M. D. M., 11 miles by railroad northwest of Keswick. Owners, Mountain Copper Company of London, England. F. B. Lawson, chairman of board of directors; A. N. Frewer, secretary; W. F. Kett, general manager; W. L. Cole, superintendent. This company controls a large acreage on Iron Mountain, between Slick Rock and Boulder creeks. Elevation varies from 2400 to 3200 feet. The mine is opened up by thousands of feet of tunnels driven from points high up the sides of the hill, and the ore has been stoped from a large portion of the ore body on the south side. Country rock is rhyolite and quartzite.

Deposit consists of massive lenses, with ''gossan'' (reddish oxide capping) on the surface, and below the capping a heavy grayish sulphide, carrying copper, gold and silver. Equipment consists of 11 miles of narrow gauge steam road which hauls the ore from the mine to the railroad (Southern Pacific Railway Company), cars, shops, 75 h.p. electric hoist, pumps, dwellings, etc. Power obtained from Northern California Power Company. The old smelter at Keswick has been dismantled and the ore is now shipped to the company's 350-ton smelter near Martinez. The company owns a large area of timber land on the Pit River, 65 miles from Keswick, and the timber is floated down the Pit and Sacramento rivers to this place. There is a large tonnage of ore blocked out in the mine; 350 men employed at present. Splendid success has been made in locating ore by means of the diamond drill. This property was worked in the eighties as a gold and silver mine, and was acquired in 1895 by London capital and the Mountain Mines Syndicate, Ltd., was formed, and in 1897 was transferred to the present Mountain Copper Company, composed practically of the same individual interests. The company has paid several millions in dividends. (For fuller details see Bull. No. 50, pp. 70–78.)

Mountain Monarch consists of 120 acres, in Secs. 28 and 32, T. 32 N., R. 6 W., 2 miles south of Stella, in the Shasta mining district. Owners, Mountain Monarch Mining Company, of Redding. W. P. Aron, president. Ore occurs in meta-andesite, and is 5 feet wide on the surface, principally malachite. A crosscut has been run for a length of over 700 feet, and some ore exposed, but main ore body has not been reached. Idle.

Ohio consists of 120 acres, patented, in Sec. 12, T. 33 N., R. 6 W., 5 miles west of Coram, in the Flat Creek mining district. Owners, Bliss Estate, of New York. Heavy sulphide ore, similar to the Iron Mountain. Several tunnels have been run, longest 530 feet. Idle.

Oregon Consolidated, in Secs. 13, 14 and 23, T. 33 N., R. 6 W., about 6 miles west of Copley. Owners, Scamman et al. Holdings consist of six claims. Development work consists of several tunnels comprising about 1500 feet in all. Some sulphide ore exposed, but the extent of the ore body not determined. Under bond at one time to the Baker Consolidated Copper Company of Detroit, Mich. Idle. Prospect.

Bibl.: Bull. No. 50, p. 113.

Pit River, consisting of 140 acres, is located in Sec. 25, T. 34 N., R. 3 W., about 3½ miles northeast of Copper City, in the Pittsburgh mining district and in the Shasta Forest Reserve. Owner, E. Popejoy. Ore and formation similar to Bully Hill. Some of the oxide ore on the surface carries good gold values. One tunnel 500′ long. A little ore shipped to smelter. One miner employed.

Polkingham consists of five claims in Sec. 11, T. 33 N., R. 2 W., 1 mile south of Ingot, in the North Cow Creek mining district and in the Shasta Forest Reserve. Owners, Polkingham Mining Company, of Ingot. R. Polkingham, president. A shaft 100 feet deep has been sunk on the croppings. Little ore in sight, some gold values in oxidized zone. Idle.

Bibl.: Bull. No. 50, p. 111.

Popejoy, in Sec. 25, T. 34 N., R. 3 W., 3 miles northeast of Copper City, in the Pittsburgh mining district and in the Shasta Forest Reserve. Owner, W. Randall. The holdings, consisting of 100 acres, adjoin the Pit River claims. Base ore similar to Bully Hill, extent of ore body not determined as development work confined to several short tunnels. Prospect. Idle.

Roseman consists of nine claims and a smelter site, in Secs. 3 and 34, T. 33 and 34 N., R. 4 W., about 6 miles east of Kennett. Owner, H. Roseman et al., of Redding. Ore occurs in or near a lime deposit, the footwall apparently being in serpentine. The formation has nothing in common with either the West Side district or the Bully Hill. Workings mainly along the outcrop, consisting of short tunnels. Idle.

Bibl.: Bull. No. 50, p. 109.

Shasta King constitutes the principal mining holding of the Trinity Copper Company, a Boston corporation; T. W. Lawson, president. The property consists of eighty-four patented claims, 580 acres on Squaw Creek and 800 acres of placer, mineral and timber lands, in Secs. 11, 12, 23, 24, 25 and 26, T. 33 N., R. 6 W., 7 miles west of Kennett. The Shasta King workings face the Balaklala, but are several hundred feet below it. The property was acquired in 1900 and development work pursued on an extensive scale for some years. The ore body has been opened up by tunnel levels, cutting it on the main level for over a distance of 1000 feet around the mountain side, and these have been connected by drifts along the footwall. The large ore body of a massive sulphide character, similar to the Balaklala, outcrops on the mountain side, forming one half of Squaw Creek canyon, course of which at the mine is east and west. The gossan croppings are very prominent and can be followed several thousand feet. A large tonnage of ore said to be blocked out. A double track incline 850′ long handles the ore from the mine to the Balaklala aerial tram. The equipment consists of large ore bins at the mine and at Coram, shops, dwellings, and a large office building in Kennett. No mining work being pursued at present. Three men employed as watchmen.

Bibl.: Bull. No. 50, p. 87.

Shasta May Blossom, formerly known as the Keith, consisting of twenty-two claims, is located in Sec. 14, T. 34 N., R. 3 W., ½ mile north of De La Mar, in the Pittsburgh mining district. Owners, Shasta May Blossom Copper Company, of Fruitvale; M. Lindley, president. Vein matter is a spar-schist footwall and granitic-porphyry hanging. A body of gossan croppings 30 feet wide is found near the top of the hill. Development work consists of 7 tunnels, aggregating 2000 feet, and several open cuts. Prospect. Two men employed.

Bibl.: Bull. No. 50, p. 100.

Spread Eagle, consisting of twenty-seven claims, in Sec. 13, T. 33 N., R. 6 W., 4 miles west of Coram, in the Flat Creek mining district, have been recently purchased by the Mammoth Mining Company. Former owner, W. G. Onn, of Copley. Development work consists of eight tunnels, aggregating about 3000 feet. Some good ore in sight.

Bibl.: Bull. No. 50, p. 85.

Stevenson consists of 140 acres, in Sec. 14, T. 33 N., R. 6 W., 3½ miles west of Coram, in the Flat Creek mining district. Owner, C. Butler. Only slightly developed by means of short tunnels and open cuts. On the main copper belt. Gossan croppings well defined.

Stowell, formerly known as the Grab, and also as the Webster Consolidated, is one of the old locations on the West Side copper belt. It consists of three claims in Sec. 14, T. 33 N., R. 6 W., 4 miles west of Coram, in the Flat Creek mining district. Owners, Stowell Estate, of Redding. Workings consist of short crosscut tunnels, aggregating about 800 feet of development work, but none has reached the objective point. One man working.

Bibl.: Bull. No. 50, p. 85.

Sugar Loaf, formerly known as the Galvin, consists of 340 acres, in Secs. 25 and 26, T. 33 N., R. 6 W., immediately northeast of the Mountain Copper Company's holdings, on Sugar Loaf Mountain, the first prominent outcrop on the copper belt after leaving the Iron Mountain mines. The formation is the same as that encountered elsewhere on the belt. Croppings of gossan, 400 feet wide in places, indicate the presence of ore bodies in the rhyolitic rocks. It is owned by the Copper Mountain Consolidated Mining Company, of Redding; J. Pilluis, president; F. Grotefend, secretary. The development work consists of twelve tunnels, aggregating over 4000 feet. No definite ore body exposed as yet. Equipment consists of air compressor, shop and dwellings. Electric power obtained from Northern California Power Company. Three men employed.

Bibl.: Bull. No. 50, p. 84.

Sulphide consists of four claims, in Sec. 16, T. 32 N., R. 6 W., ½ mile from Stella, in the Shasta mining district. Owner, J. F. Conkling. A shallow exploration tunnel run along a contact shows up low grade sulphides carrying a little gold. Prospect. Idle.

Summit Group, owned by the Stauffer Chemical Company of San Francisco, is located in Sec. 30, T. 34 N., R. 5 W., 4 miles northwest of Kennett, in the Backbone mining district. Chas. Kunze, of Kennett, superintendent. This property is situated on the eastern slope of Bohematosh Mountain, and adjoins the Mammoth Company's holdings on the west. The country rock is heavily mineralized, and the ore body is the same in character as the more southerly part of the copper belt. Extent of ore body not determined, but is over 30 feet wide in places. The workings consist of three tunnels, one 400 feet long, and a 350-foot raise. A 4-drill Sullivan compressor, shop and dwellings constitute the surface equipment. Five men employed.

Bibl.: Bull. No. 50, p. 97.

GOLD.

The gold production record of Shasta County from 1880 is derived principally from two sources—the smelting of base ores, and the milling of quartz (siliceous ores).

The closing down of all but one of the smelters has caused a material decrease in the amount of gold produced, and several of the quartz mines supplying ore to these plants have stopped operations also. Adjacent to different parts of the copper belt are gold quartz districts, in which are many veins carrying low, medium, or high grade ores, which are base, as a rule, and can not be efficiently and profitably reduced by milling processes. They occur notably in the vicinity of the old town of Shasta, 4 miles south of Iron Mountain, and are distributed for several miles south and east of this end of the belt, especially through the Shasta, Flat Creek and Old Diggings districts. In fact, gold quartz veins are abundant in close proximity to the copper belt generally, and the smelters have created a market for these ores and enabled the development of a number of quartz properties.

In 1912 the quartz mines produced \$702,267 in gold and \$4,200 in silver, while the copper smelters yielded \$220,775 gold and \$420,894 silver.

French Gulch, 21 miles northwest of Redding, the most active quartz mining district in Shasta County, produced \$380,305 in gold in 1912, or over 50% of the gold yield from siliceous ores. The Gladstone, one of the famous quartz mines in this county, is the largest producer in this district, next in order being the Milkmaid and Franklin, Brunswick, El Dorado and Eureka, Halcyon, Summit, and Washington.

The *Midas,* another famous quartz mine, is the only gold producer in the Harrison Gulch district.

There are also a few small quartz producers near Stella, Buckeye, Igo, Kennett, Keswick and Ono.

Placer mining is very limited, the dredging operations near Redding affording the largest output. A small production is reported from the placers at French Gulch, Bayles (Delta), and Lamoine.

HISTORY.

Reading, of Trinity fame, gave his name to the district which sprang up in 1849 around Clear Creek and lifted Shasta City to prosperity. In this district, centering around Shasta, were a number of camps along and near Clear Creek, the most famous being Horsetown, which passed out of existence years ago. The bed of the creek proved rich and by the autumn of 1850 several dams were placed to turn the current. This stream is now being worked by means of a dredge.

The main Sacramento River toward Soda Springs, acquired fame chiefly in 1850 when Dog Creek and other tributaries lured the prospector. Dredging operations are being pursued at the present time on the Sacramento River, just above Redding.

Placer gold was discovered in the region of Bully Hill as early as 1853, which became known as the Pittsburgh district. With this discovery began a stampede which resulted in the location of a large number of placer claims, many of which were of little value, and active interest lapsed before 1870.

In 1862 gold was discovered in the surface rock near Copper City, and when the ore was found to contain silver as well as gold, there was another rush into this district and a search begun for the supposed rich veins of gold and silver. Bully Hill was located at this time.

Eight quartz mills, comprising a total of 60 stamps, had been erected in this county prior to the year 1896, three mills (40 stamps), being in operation in French Gulch at that time.

The *Washington Mine,* near French Gulch, discovered in 1852, is said to be the first quartz location in Shasta County, and in 1869 had the largest mill, consisting of 22 stamps. This property is still worked in a limited way and a small production obtained. All the old workings are caved.

In 1877 a mill was erected at Copper City to work ore from the Bully Hill, and during a period of three years over $640,000 was produced, the surface ore only being worked.

The principal gold quartz deposits are fissure veins, generally narrow, having steep dips, and occurring either in slate or in meta-andesite, and associated as a rule with porphyry dikes. The usual trend of the fissure is east and west, though minor variations are found occasionally.

GEOLOGY OF DISTRICTS.

The deposits in the French Gulch district lie within the area of slate and conglomerate, generally associated with intrusive granite porphyry dikes. The workings in the Gladstone mine clearly demonstrate the persistency of the ore bodies with depth.

A good wagon road connects French Gulch with Redding, the county seat and freight terminal for this district. The haul is about 21 miles over an easy grade.

The line of the Northern California Power Company passes through the district, so that cheap electrical power is at hand.

The topography of the county is such as to afford good tunnel sites. Mining operations can be pursued throughout the entire year. The cost of mining is reasonable.

Bibl.: Report X, p. 635; U. S. Geol. Surv., Bull. No. 540, pp. 31, 55, 56.

In the vicinity of *Stella,* 11 miles northwest of Redding, the fissure veins cut the quartz diorite and alaskite porphyry, and the pay ore is apparently found along the edge of the latter. This district is said to rank next to French Gulch in total gold output. At the present time none of the properties are being worked on an extensive scale, hence the output is small.

Bibl.: U. S. Geol. Surv., Bul. No. 540, p. 47.

In the *Dog Creek District* the deposits are all within the areas of meta-andesite, cut by dikes of feldspathic dacite porphyry and occasionally alaskite. The pay ores exposed in the development work consist of irregular shoots, but the extent of these bodies has not been determined as yet. Delta, the nearest railroad point, is on the edge of this district, and a narrow gauge railroad extends from this station westerly for a distance of 7 miles. A number of promising quartz properties have been developed to a limited extent in this district, and the numerous ledges of pay ore should lead to considerable production in the near future.

Bibl.: U. S. Geol. Surv., Bull. No. 540, p. 71.

The gold zone extends from the base ore belt, southwesterly, to the extreme boundary of Shasta County, including Igo, Ono and Harrison Gulch districts.

The *Igo District* is 13 miles southwest of Redding, and some good placer ground has been worked in this section. The débris law has stopped hydraulic operations. The quartz mining has been carried on to a limited extent. The pay shoots are short but carry good values in gold. Good wagon road from Redding to the town of Igo. The same general conditions apply to Ono, some 7 miles west of Igo.

The *Harrison Gulch District,* 50 miles southwesterly from Redding near the Trinity County line, is known principally on account of the Midas mine. Here the ore occurs in slate, near a porphyry dike, and considerable evidence of faulting is found. The pay shoot has an average width of 12 inches. The haul is rather expensive, as two mountain ranges must be crossed.

The *Squaw Creek District,* extending westerly from Kennett, contains both base and free milling ores. The Uncle Sam gold mine is in this district. Rich pockets are often found along the contact of slate and meta-andesite and many prospectors have made a stake by ''pocket hunting.'' The direct cause of several of the failures in lode mining is due to the installation of mills more elaborate than the size of the ore body justified.

Bibl.: Report X, p. 639

AURIFEROUS GRAVEL.

An immense deposit of auriferous gravel, commencing southwesterly from the city of Redding, in Sec. 36, T. 31 N., R. 6 W., near the old site of Horsetown and trending east to the foothills of the Lassen Buttes and down the Sacramento Valley, has been extensively worked in the past.

Oregon Gulch, about 10 miles in length, was exceedingly rich and was worked from its source to the valley. It empties into the Sacramento River 1½ miles south of Redding.

Onley Creek, another rich stream, heads in the Muletown Mountains, runs in a southeasterly course and empties into the Sacramento River about 1 mile south of Oregon Gulch.

An old river bed, having a general northeast and southwest course, and crossing the Sacramento River one mile north of Redding at right angles has been traced from the northeast to the western boundary of the State. It passes through the old site of Horsetown, thence westerly and southeast of Igo; here it turns to the southwest and passes through the old town of Ono, and can then be traced from here to Watson's Gulch, and thence into Arbuckle. This channel can be distinctly observed on the top of Arbuckle Mountain, 3000 feet above sea level; from which point it takes a short bend and runs in a westerly direction to Knob Gulch and can be traced up this gulch for over 10 miles. The placers of Knob Gulch were very rich where the channel crossed it. Upon approaching the Chauchalua Mountains all traces of the river bed disappear and are not again visible until Hay Fork, in Trinity County, is reached. From that point it takes its regular course, passes through Humboldt County and empties into the Pacific Ocean at Gold Bluff.

Hazel Creek, some 15 miles long, was worked in early days throughout its entire length, the gravel being very rich. This stream, after flowing southwesterly through country rock of slate and granite, empties into the Sacramento River in Sec. 18, T. 37 N., R. 4 W., near Sims Station.

DREDGING.

There are several thousand acres of dredging ground along Clear Creek and the Sacramento River. Some of the land adjacent to the town of Igo is being drilled to determine dredging possibilities. Only two dredges are in operation in Shasta County at the present time, one on Clear Creek a few miles below Redding, and the other on the Sacramento River just above that city. The ground along Clear Creek, on which dredging is being pursued, averages 20 feet in depth, the gravel being loose river wash, carrying few large boulders and only a little clay. The contour of the ground is fairly even and the timber growth is scattered. The gold is generally fairly coarse and worth about $19 per ounce. Conditions for economical working are very favorable.

Suction dredges have been operated along the Sacramento River, above Redding, and also along Clear Creek, but with poor success.

William Desilhorst successfully operated a steam scoop along Clear Creek for several years, but the best ground has evidently been worked out as the plant has been idle for some time.

Bibl.: Bull. No. 57, pp. 213–218.

GOLD MINES—QUARTZ AND PLACER.

Accident, formerly known as the *Sybel,* consists of 80 acres, patented, in Sec. 7, T. 33 N., R. 7 W., about 5 miles northwest of French Gulch, in the French Gulch mining district. Owners, Accident Gold Mining Company; home office, Redding; G. E. Garwood, president. Elevation at mine workings 3700 feet. Three veins on claims. Slate foot and diorite-porphyry hanging-walls. Strike N. 80° W., dip 50° N. Ore shoot 100 feet long and 3 feet wide, free milling. Workings consist of a tunnel 2200 feet long, 400 feet of drifts, and a 100-foot stope. Reduction equipment consists of a 4-foot Huntington mill, operated by steam power. Property said to have been a producer. Idle. Prospect.

Bibl.: U. S. Geol. Surv., Bull. No. 540, pp. 68–69.

Advance Consolidated, consisting of 135 acres (20 acres patented), is located in Sec. 2, T. 35 N., R. 6 W., 7 miles west of Delta, and ½ mile from the Delta Consolidated Railroad, in the Dog Creek mining district. Owners, Advance Consolidated Mining Company of San Francisco. Three parallel veins on this group 4 feet wide. Andesite footwall and diorite hanging, strike east and west, dip vertical. Pay shoot 400 feet long and 4 feet wide, free milling. Workings consist of four tunnels on the vein from 50 to 1100 feet long, and 1000 feet of drifts, stopes and raises. Reduction plant consists of old rolls (six in number), crusher, 50-ton cyanide plant (failure). Small producer. Considerable money expended on plant and in experimenting with the ore. Delta Consolidated to the east, and Trinity Consolidated to the south. One man working.

Alice, consists of 120 acres, in Sec. 19, T. 32 N., R. 5 W., 1 mile southwest of Keswick, in the Shasta mining district. Owner, F. Bonte. Three parallel veins 3 feet wide, strike N. 60° E., dip S. 75° E., granitic-porphyry walls. Pay shoot 80 feet long and 3 feet wide, free milling. Best ore has a width of 8 inches. One tunnel 600 feet long on the veins, short stope and 200-foot drift. Reduction equipment consists of an old 4-stamp mill (850-pound stamps). Idle. Small producer at one time. Three men doing some prospecting work.

Bibl.: Reports XII, p. 245; XIII, p. 349.

Al Toland, consists of 60 acres, in the Shasta Forest Reserve, in Sec. 28, T. 36 N., R. 6 W., 7½ miles west of Delta and 1½ miles west of Delta Consolidated Railroad, in the Dog Creek mining district, Owner, A. L. Toland. Elevation 3700 feet. One vein on claims, width 2½ feet, strike NW. and SE., dip 45° SW., pay shoot 110 feet long and 2½ feet wide, free milling. Workings consist of several short tunnels. Main tunnel 200 feet long and 180-foot winze at face of same; short drift and stope. Old 2-stamp mill, steam driven. Idle. Small producer, some high grade. Two men employed.

American Mine, formerly known as the *French Gulch,* adjoins the Gladstone on the west, the workings consisting of tunnels at several elevations between 2500 and 3150 feet on the north ridge of Cline Gulch. This group is located in Secs. 12 and 13, T. 33 N., R. 7 W., 3½ miles northeast of French Gulch, in the French Gulch mining district. The holdings consist of 60 acres, patented, and 40 acres held by location. Owners are W. Franck et al., of French Gulch. The country rock consists of slate and conglomerate. Fissure vein has a strike of N. 63°–80° W., and a dip of S. 75° E.; slate walls. Pay shoot 125 feet long and 2 feet wide, free milling. Length driven on vein 1400 feet in tunnel, greatest depth 650 feet; four tunnels from 50 to 1400 feet in length; one stope 125 feet long and 240 feet in height; 80-foot winze and 300-foot raise. Mining and filling method used. Some of the old workings caved. Mine equipment consists of ¼ mile single track tram (mine to mill), cars, shop and dwellings. The old 10-stamp mill, steam driven, is idle. Two men employed doing prospect work. Property said to have produced $300,000. Rich ore worked from the surface. Located in 1886, and sold to a San Francisco company which became involved in financial difficulties, and finally acquired by the present owners, the creditors. Not worked on any scale since 1908.

Bibl.: Reports, VIII, pp. 564–565; X, p. 637; XII, p. 245; XIII, p. 349; U. S. Geol. Surv., Bull. No. 540, pp. 35, 60–61.

Atlantic, consists of 100 acres, in Secs. 17 and 20, T. 31 N., R. 6 W., 3 miles northwest of the town of Igo, in the Igo mining district. Owner, W. L. Kingsbury. Two parallel veins about 150 feet apart have been worked in a small way. Pay shoot 70′ long and 15″ wide, in granite. One tunnel on vein for a distance of 440 feet. A little ore shipped to Selby smelter gave returns of $80 per ton in gold. Small producer. Two men employed.

Australia, consists of 80 acres, in Secs. 19 and 30, T. 32 N., R. 6 W., 3 miles north of the old town of Shasta in the Shasta mining district. Owner, M. Garrecht. Elevation at main tunnel 1300 feet. Three veins, two parallel, on the claims; only parallel veins have been worked. Strike east and west, dip 60° N., meta-andesite footwall and granitic porphyry hanging. Pay shoot 60 feet long and 4 feet wide. Workings consist of three tunnels on the veins, longest tunnel 340 feet with a 40-foot winze at the face. Old 3-stamp mill, driven by water power from Brandy Creek (ditch 1 mile long), is idle. Stamps weigh 850 pounds each. Small producer. Two men employed.

Bibl.: Report XIII, p. 362.

Black Bear, consists of 80 acres, in Sec. 9, T. 29 N., R. 10 W., 1 mile south of Harrison Gulch, in the Harrison Gulch mining district. Owners, W. D. Lilly et al., of Redding. One vein 5′ wide in slate, only slightly developed. Two short tunnels.

Black Hawk, consists of 80 acres in Sec. 14, T. 31 N., R. 6 W., about 1 mile northwest of Centerville, in the Igo (formerly South Fork) mining district. Owner, W. Dunham. One vein, meta-andesite walls, only small amount of development work by a tunnel 400′ long. Little ore taken out. Idle. Prospect.

Black Spider, consists of 80 acres, in Sec. 19, T. 32 N., R. 5 W., about 1½ miles southwest of Keswick. Owner, R. Bell. Workings consist of old shaft 460 feet deep, a 420-foot tunnel, and short drifts. Ore shoot 160 feet long and 6 feet wide, free milling, but low grade. Little ore extracted. Idle. Alice prospect to the east.

Bibl.: Reports XII, p. 246; XIII, p. 350.

Bodie, in Secs. 6 and 32, T. 32 and 33 N., R. 7 W., about 3 miles southwest of French Gulch, in the French Gulch mining district, consists of 40 acres, at an elevation of 3800 feet. Owner, F. B. Rossi.

Vein occurs between a granodiorite footwall and a granitic-porphyry hanging. Pay shoot 250 feet long and 2 feet wide, free milling. Workings consist of a tunnel 560 feet long on the vein, 400 feet of drifts, stope 110 feet in length and a 40-foot shaft (caved). Old 5-stamp mill has been removed from the property. Small producer at one time. Idle.

Bonanza, in Sec. 6, T. 32 N., R. 6 W., 4 miles northwest of Stella (old Whiskeytown), consists of 60 acres, at an elevation of 1600 feet. Owner, M. C. Dewey et al., of Stella. Three veins, two parallel about 300 feet apart, and one cutting these at an angle of 40°. The vein that has been worked has a north and south strike, and dips 50° southeast, slate footwall and granitic-porphyry hanging. This vein is cut by a diorite dike 20 feet wide, with an east and west strike. Pay shoot is 120 feet long and 14 inches wide. Workings consist of three tunnels about 50 feet apart—lower 180 feet long, middle 120 feet, and upper 60 feet long. Bright Star to west. Idle.

Bright Star, formerly known as the *Iron Mask,* consisting of 120 acres, is located in Sec. 31, T. 32 N., R. 6 W., about 4½ miles northwest of Stella, in the Shasta mining district. Owner, S. W. Levy, of San Francisco. Elevation 2400 feet. The vein has a north and south strike, and a dip of 60° E., slate footwall and granitic-porphyry hanging. Pay shoot said to be 200 feet long and 16 inches wide. Workings consist of two tunnels. Main tunnel on vein is 900 feet long and crosscut 180 feet in length, also 450 feet of drifts and a stope 200 feet long. Old 5-stamp mill idle, driven by water; ditch 2 miles long, from Whiskey Creek. Property has been a producer but idle at present. Bonanza to the west.

Bibl.: Report XII, p. 250; U. S. Geol. Surv., Bull. No. 540, p. 55.

Brunswick, consists of 100 acres, in Sec. 20, T. 33 N., R. 7 W., 5 miles west of French Gulch, in the French Gulch mining district. Elevation 3200 feet. Owners, Brunswick Mining Company. Two parallel veins. Strike east and west, dip 60° N., quartz-porphyry footwall and slate hanging. Pay shoot said to be 250 feet long and 6 feet wide, free milling. About 6 inches of good ore on hanging-wall side. Five tunnels run on the vein, from 100 to 800 feet in length, 700 feet of drifts, a stope 200 feet long and several open cuts, constitute the development work. Old 5-stamp mill idle. Said to have produced $100,000. Idle.

Bibl.: Report XIII, p. 351; U. S. G. S., Bull. No. 540, pp. 35, 37, 68.

Bulwer and *Virginia,* in Sec. 18, T. 33 N., R. 7 W., 5 miles northwest of French Gulch, in the French Gulch mining district, consists of 40 acres. Elevation 2400 feet. Owners, J. Reinhaus et al., of French

Gulch. Three parallel veins on the claims, strike north and south, dip 65° E., granitic-porphyry footwall and slate hanging. Ore shoot 200 feet long and 2 feet wide, free milling, 700-foot tunnel on the vein. Little ore extracted. Idle.

Bunker Hill consists of 60 acres, patented, in Sec. 29, T. 32 N., R. 5 W., 3 miles east of Shasta, in the Shasta mining district. Owners, Pryor and Logan. Elevation 1000 feet. One vein 5 feet wide, strike north and south, dip 40° E., granitic-porphyry walls. Workings consist of a tunnel 460 feet long and 200 feet of drifts. Idle.

Calumet Consolidated, consisting of 80 acres of patented mineral land, is located in Sec. 20, T. 32 N., R. 5 W., about 1 mile south of Keswick. Owners, Dr. Garlick et al., of San Francisco. Elevation at tunnel 750 feet. Only one of the several veins on the claims has been worked. Strike is east and west, dip 15° N., diorite walls. Pay shoot over 200 feet long, with an average width of 20 inches. Ore is free milling near the surface, but tends to become base with depth (copper sulphides). Maximum depth on vein about 250 feet. The workings consist of a tunnel on the vein 1100 feet long, several hundred feet of drifts, raises and stopes. The reduction equipment consists of a 40-stamp mill (old), steam driven, four Frue vanners, and an old 10-ton chlorination plant. Mine was a producer at one time, but has not been worked in recent years. Inez to north.

Bibl.: Reports, VIII, p. 563; X, p. 631; XI, pp. 43, 395.

Carnegie Group, Ltd., formerly known as the *Clipper* and *Snider,* is located in Sec. 1, T. 33 N., R. 6 W., 7½ miles west of Kennett, in the Flat Creek mining district. The group, consisting of 120 acres, patented, is owned by A. Di Nola et al., of San Francisco. Elevation 2300 feet. The vein has an east and west strike and dips 45° N., average width 2½ inches; granitic-porphyry walls. Pay shoot 200 feet long and 2½ feet wide, free milling. The workings consist of a shaft 230 feet deep, with three levels at 50′, 150′ and 200′, drifts, 50-foot raise, and a stope 130 feet long, as well as a 460-foot tunnel, all on the vein. The reduction equipment consists of a 10-stamp mill, steam driven, two Frue vanners and blanket table. Idle. Property has been a producer but idle at present. Some ore in sight. Mentioned in our eleventh, twelfth and thirteenth reports.

Central, consists of 80 acres, patented, in Sec. 33, T. 33 N., R. 5 W., 2½ miles east of Copley, in the Flat Creek mining district. Owner, A. A. Anthony, of Whitehouse. Elevation 1500 feet. Two parallel veins about 150 feet apart on the claims, strike north and south, dip 40° E., quartz-porphyry walls. Pay shoot 230 feet long and 6 feet wide, free milling near the surface but base with depth (copper sulphides). Workings consist of a tunnel on the vein, 1340 feet long, 900 feet of drifts and one stope. Old 6-foot Huntington mill, steam driven, Some production from the oxidized ore near the surface. Idle.

Bibl.: Reports, VIII, pp. 565-566; X, p. 631; XII, p. 246; XIII, p. 351.

Chapman and *Voluntine* (drift and hydraulic) mine, consists of 100 acres, patented, in Sec. 25, T. 36 N., R. 6 W., ¾ of a mile south of Centerville. Owner, C. A. Chapman of Redding. Course of channel, northeast and southwest, soft granite bedrock. Pay gravel about 20 feet deep. Worked as a drift mine for some years, and then as a hydraulic proposition. Water obtained from Happy Valley ditch. Good producer until operations were stopped some twelve years ago on account of the debris law. Some good ground yet to be worked. Princess placer to the southwest.

Clara, consisting of 60 acres, patented, is located in Sec. 17, T. 32, N., R. 5 W., ½ mile west of Keswick. Owner, O. La Platte. Elevation 1000 feet. Three parallel veins, granitic-porphyry walls. Pay shoot 160 feet long and 20 inches wide, free milling. Tunnel on main vein 700 feet long. A little high grade extracted. Prospect. Idle.

Cleveland, consists of 60 acres, patented, in Sec. 15, T. 32 N., R. 5 W., 4 miles west of Redding, in the Shasta mining district. Owner, D. H. Hunt, of Redding. Elevation 800 feet. Vein is 15 inches wide between diorite walls, strike northwest, dip S. 60° W. Pay shoot said to be 200 feet long and 15 inches wide. Ore is base, carrying gold with sulphides of copper, lead and iron. Worked for gold. Some rich ore shipped to smelter. Only slightly developed by 200-foot tunnel, drift and stope. Idle.

Climax, consists of 60 acres, in Secs. 16 and 21, T. 31 N., R. 6 W., about 3 miles northwest of Igo. Owner, S. W. Robinson. One vein in granite. Ore shoot short, free near surface but base with depth. Only limited amount of development work by means of short tunnels. Old Justin mill dismantled. Has been a small producer. Worked a few months each year. Prospect.

Colorado, in Secs. 16 and 17, T. 33 N., R. 7 W., 3 miles northwest of French Gulch, in the French Gulch mining district, consists of 80 acres. Elevation 1600 feet. Owner, T. McDonald of French Gulch. Vein is 10 inches wide, strike northeast and southwest, dip 40° N., granite-porphyry footwall and slate hanging. Ore shoot 160 feet long, free milling, 400-foot tunnel on the vein. Idle.

Compton, consists of 40 acres, in Sec. 20, T. 32 N., R. 5 W., 1¼ miles south of Keswick, in the Shasta mining district. Owner, G. F. Bassett. Elevation 900 feet. One vein in granitic-porphyry. Short pay shoot. Slightly developed by short tunnel and drift. One man working.

Consolidated Gold Dredging Company, operating along the Sacramento River, own 260 acres, in Secs. 20 and 28, T. 32 N., R. 5 W., about 1½ miles northeast of Redding. W. F. McClure is president of the company, and W. D. Egilbert, superintendent of dredge. Course of channel is north and south, slate bedrock, hard and tilted. Depth of pay gravel from 8 to 20 feet. Dredge equipped with 5-foot buckets and handles about 50,000 cubic yards of gravel per month. Power is obtained from Northern California Power Company. Twelve men employed.

Consolidated Kascinaska, formerly known as *Quartz Hill,* in Sec. 10, T. 32 N., R. 5 W., 4 miles southwest of Redding. Owners, Kascinaska Mining Company, Chicago, Illinois. Holdings consist of 80 acres, patented, at an elevation of 950 feet. Two parallel veins strike N. 40° W., dip 50° W., slate footwall and quartz-porphyry hanging, width of vein 8 inches. Pay shoot 140 feet long and 4 feet wide, free milling, low grade. Workings consist of several tunnels from 50 to 480 feet long, drifts and stopes. Idle for several years. Mentioned in our Twelfth and Thirteenth Reports.

Copley, consists of 60 acres, in Sec. 32, T. 33 N., R. 5 W., near the town of Copley, in the Flat Creek mining district. Owner, J. R. King. Elevation 860 feet. Worked the oxidized ore on the surface for the free gold, but with depth the ore became base, still carrying best values in gold. One vein, strike northeast and southwest, dip 60° NE., width 4 feet. Length of pay shoot not determined. Workings consist of 310-foot tunnel, 60-foot drift and stope 60 feet long. Owner doing assessment work.

Bibl.: Report XIII, p. 352.

Corrine, consists of 160 acres, in Sec. 32, T. 32 N., R. 5 W., 1 mile west of Redding, in the Shasta mining district. Owners, E. P. and J. C. Connor of Redding. Elevation 800 feet. Two parallel veins, strike northeast and southwest, dip vertical. Pay shoot 200 feet long and 15 inches wide, free milling, carrying rich sulphurets. Workings consist of four tunnels from 60 to 430 feet long, and old 110-foot shaft, 600 feet of drifts and a stope 160 feet long. Reduction equipment consists of 5-stamp mill (750-pound stamps), and one Wilfley table. Idle. Property was a producer at one time. Two men at work.

Cortez, consisting of 65 acres, is located in Sec. 10, T. 33 N., R. 2 W., ½ mile northwest of Ingot, in the North Cow Creek mining district. Owner, A. J. Cook, of Ingot. Elevation, 1400 feet. Two parallel veins about 40 feet apart. Length of pay shoot not determined. Vein on contact between rhyolite and shale. Three short tunnels on veins. Afterthought copper mine to northeast. One man working.

Bibl.: Reports, XII, p. 70; XIII, p. 352.

Crystal, consists of 60 acres, in Sec. 17, T. 31 N., R. 6 W., 3 miles northwest of Igo, in the Igo mining district. Owners, Kingsbury & Hubbard. Three parallel veins in granite. Ore is a grayish gold-silver sulphide. Pay shoot short and values are not uniform. Only slightly developed with short tunnels. A little ore shipped to smelter gave returns of $50 per ton in gold and silver. Worked a few months during the year. Prospect.

Delta Consolidated, the largest quartz property in the Dog Creek mining district, is located in Secs. 1, 3, 6, and 31, T. 35 and 36 N., R. 5 W., 6½ miles west of Delta. The holdings consist of 650 acres (80 acres patented timber land) in the Shasta Forest Reserve. Owners are the Delta Consolidated Mining Company of Redding. S. T. White, president; S. D. Furber, secretary. Elevation varies from 2800 to 3000 feet. The mine is connected with Delta, a station on the Oregon branch of the Southern Pacific Railroad, by means of a narrow guage railroad, 6½ miles long, constructed by the company. There are 10 veins on the claims. The principal lodes, known as the Pioneer, Rickard, Scorpion, Black Oak and Caledonia, have a strike of N. 70° E., and a vertical dip, and can be traced on the surface for several thousand feet. The walls are andesite. Pay shoot is said to be 800 feet long and 18 inches wide, free milling. Maximum depth on ore body is 300 feet. Workings consist of several tunnels on the veins, from 20 to 1600 feet in length, drifts, nine raises from 100 to 200 feet high, and a stope 200 feet long. Mine equipment consists of cars, one Climax geared engine, tools, shop and dwellings. The reduction equipment consists of three separate mills, with a total of 10 stamps, operated by water power obtained from Dog Creek. Ore reserve estimated at 20,000 tons. Cost about $4.25 per ton to work. Ample timber at hand. Three men employed at present, but force to be increased shortly. Rich ore worked years ago in an arrastra. Advance Consolidated to the west, and Trinity Consolidated to the south.

Bibl.: Report XIII, p. 353.

Diamond, formerly known as *Black Prince,* consists of 80 acres, in Sec. 18, T. 31 N., R 6 W., 4 miles northwest of Igo, in the Igo mining district. Owner, S. W. Robinson. Four veins on the group, but only one, the Black Prince, has been worked. Granite footwall and meta-andesite hanging. Pay shoot 100 feet long and 2 feet wide, ore base below the surface. A tunnel 400 feet long, short drifts, and one stope on the vein. Ore shipped to smelter gave returns of $50 per ton in gold and silver. Prospect being worked by Roberts & Wheeler of Igo, under a lease.

Bibl.: Report XIII, p. 355.

Edna B., in Sec. 6, T. 31 N., R. 5 W., 1½ miles east of Shasta, in the Shasta mining district, consists of 100 acres, owned by J. H. Beecher of Anderson. Elevation 1300 feet. One vein 3 feet wide, quartz-porphyry walls, strike northeast and southwest, dip 45° E. Pay shoot 200 feet long and 3 feet wide, free milling. Workings consist of a tunnel 500 feet long on the vein and 400 feet of drifts. Small producer at one time. Idle.

Bibl.: Reports XII, p. 247; XIII, p. 355.

El Dorado and Eureka, consisting of 40 acres, is located in Sec. 3, T. 32 N., R. 7 W., 3½ miles south of French Gulch, in the French Gulch mining district. Elevation 3000 feet. Owner, J. C. Connor, of Redding. Two parallel veins on claims, slate footwall and quartz-porphyry hanging; strike is northwest and southeast, dip 45° SE. Pay shoot 240 feet long and 3 feet wide, free milling. Workings consist of a tunnel 580 feet long on the vein and 300 feet of drifts. Small producer. Two men employed.

Bibl.: Reports XII, p. 247; XIII, p. 355; U. S. Geol. Surv. Bull. No. 540, pp. 56, 57.

Empire, consists of 60 acres, patented, in Sec. 18, T. 33 N., R. 7 W., 5 miles northwest of French Gulch in the French Gulch mining district. Elevation 3000 feet. Owners, J. E. Franck et al., of French Gulch. Property formerly owned by the Empire Mining Company of Salt Lake City, Utah. One vein has been worked. Strike east and west, dip 15° N. granitic-porphyry footwall and slate hanging. Ore shoot 100 feet long and 6 feet wide. Workings consist of four tunnels from 115 to 500 feet long, 300 feet of drifts and one stope 100 feet long. Old 5-stamp mill, steam driven. Idle. A small producer several years ago. One man working.

Bibl.: Report XIII, p. 356.

Empire, consists of 120 acres, in Sec. 9, T. 30 N., R. 7 W., 3 miles southwest of town of Ono, in the Ono mining district. Owners, McCormick and Murray Estate, of Redding. Two parallel veins exposed on the surface, with slate walls. Pay shoot about 80 feet long and 1 foot wide, ore free milling. Only slightly developed by a tunnel 500 feet long. Little ore shipped to smelter. Idle.

Esperanza, consists of 160 acres, in Sec. 29, T. 29 N., R. 10 W., about 1½ miles east of Harrison Gulch, in the Harrison Gulch mining district. Owner, A. J. Oswald. Four veins exposed on the surface, three being parallel. A shaft has been sunk on the Lucky George claim to a depth of 214 feet, and three crosscuts run, longest 141 feet, working through a fault. A little ore on the surface. A 12 h.p. steam hoist used. Four men employed. Prospect.

Eureka Tellurium, consisting of 290 acres, near Middle Creek, is located in Sec. 32, T. 32 N., R. 5 W., 3 miles southwest of Redding. Owners, Eureka Tellurium Company, J. E. Jarvis, president. Elevation 700 feet. Ten veins on the group, but only one has been worked. Strike N. 25° E., dip 60° E., width 3 feet; walls are slate. Pay shoot 130 feet long and 3 feet wide, free milling on surface, but base with depth. Ore said to contain tellurides. Several tunnels on the vein, main tunnel is 520 feet long. A furnace 5 feet by 20 feet, with 8-foot agitators, 16 barrels, 3 feet by 4 feet, hollow and egg-shaped, and a 4-foot steam filter, with a small precipitating vat, constituted the reduction equipment. Small production from property some years ago. Idle.

Bibl.: Reports, XI, p. 43; XII, p. 248; XIII, p. 356.

Evening Star, consists of 60 acres, patented, in Sec. 4, T. 32 N., R. 5 W., 2 miles southeast of Copley, in the Flat Creek mining district. Owners, Estate of F. Litsch. Three parallel veins, strike N. 50° W., dip 50° S., greenstone footwall and granitic-porphyry hanging. Pay shoot 230 feet long and 14 inches wide, free milling. Development work consists of a tunnel 1100 feet long and 1000 feet of drifts. Three men employed.

Florence, consists of 60 acres, in Sec. 18 T. 30 N., R. 7 W., about 8 miles southwest of Ono. Owner, A. E. Baker. One vein 10 feet wide, has been slightly developed, strike N. 30° W., dip 40° E., slate walls. Ore is low grade and base, carrying some copper, lead and zinc, besides gold. Idle.

Franklin, consists of 40 acres, in Sec. 10, T. 33 N., R. 2 W., 1 mile southwest of Ingot, in the North Cow Creek mining district. Owner, J. A. Cook, of Oakland. Short ore shoot in which some high grade is found. Worked by lessees at times. Only slightly developed by short tunnels.

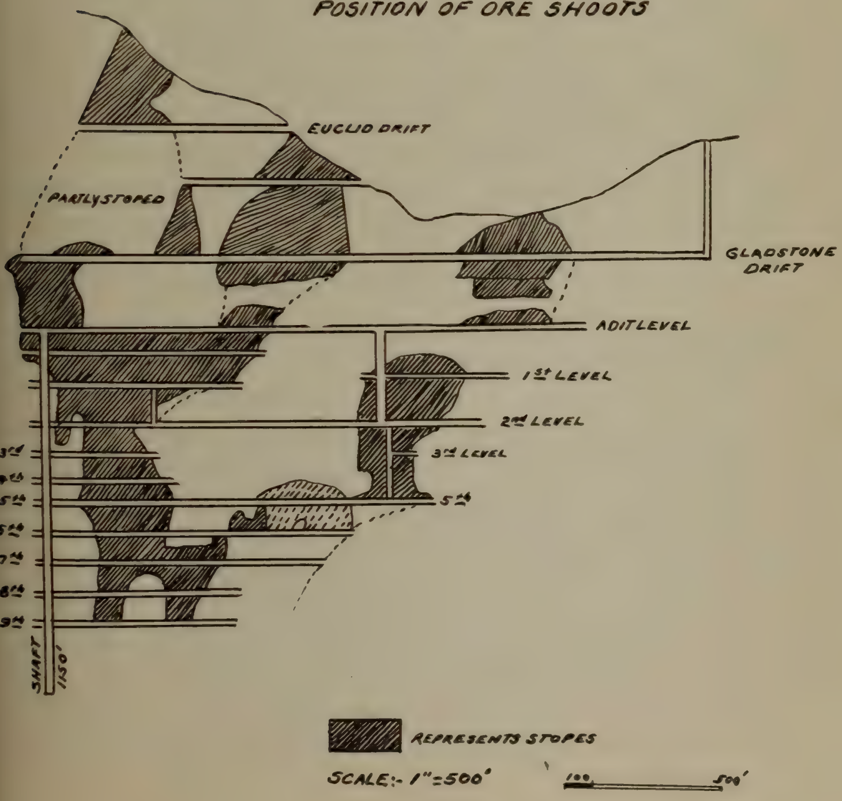
Gambrinus Mine, discovered in 1870, is located in Sec. 16, T. 32 N., R. 6 W., in the town of Stella (Whiskeytown). This well known property is owned by the Shasta Monarch Mining Company, of Redding. T. W. Rogers, superintendent. The holdings consist of 80 acres. Elevation about 1200 feet. There are four parallel veins on the group, three being only 60 feet apart, strike is N. 50° W., dip 45° N., meta-andesite footwall and quartz porphyry hanging. The pay shoot is 220 feet long and 18 inches wide, free milling ore. The workings consist of several tunnels, the main tunnel being 410 feet long on the vein, stopes and drifts, also a crosscut 110 feet long. The mine equipment consists of cars, tools, shop and dwellings. A new 10-stamp mill with two concentrators constitute the reduction equipment, operated by steam power. Property has been a producer for many years and was worked in the early days by gophering along the rich surface streaks. The tailings are dumped into Whiskey Creek. Ten men employed.

Bibl.: U. S. Geol. Surv., Bull. No. 540, pp. 38, 39, 50, 51.

Garfield, consisting of 80 acres, is located in Sec. 34, T. 33 N., R. 5 W., 2 miles east of Copley, in the Flat Creek mining district. Elevation, 1200 feet. Owner, George Barr. One vein, strike N. 50° E., dip 40° E., quartz-porphyry walls. Ore shoot 90 feet long and 2 feet wide, free milling. One tunnel 570 feet long and 230-foot drift. Small producer. Two men employed. Sam Houston to the north.

Gladstone, the largest quartz producer in Shasta County, is located in Secs. 1, 7, 8, 12 and 18, T. 33 N., R. 6 and 7 W., M. D. M., about 4½ miles northeast of the town of French Gulch, in the French Gulch mining district. The holdings consist of 178 acres, patented, and 485 acres held by location, at an elevation of 2300 feet. It was acquired in 1901 by the present owners, Hazel Gold Mining Company, J. O. Jillson, presi-

SECTION ALONG GLADSTONE VEIN
SHOWING
POSITION OF ORE SHOOTS



dent and manager; E. L. Young, superintendent. The upper 1000 feet of the vein has been mined by means of tunnels, while the lower portion is worked from a blind shaft on the main adit level, and is developed by three levels (see map). The exhausted stopes and upper workings are filled with waste obtained in crosscutting. The country rock consists of slate, conglomerate and sandstone. There are two fissure veins that have been worked, strike east and west, dip vertical, width 3 feet; both walls are slate. The ore shoot is 300 feet long and 3 feet wide, free milling ore. Length driven on vein 2500 feet. Greatest depth 2100 feet. Workings consist of eleven levels below the main adit, the lowest being 1150 feet below the adit; all drifts to the east, No. 3 being the shortest, having a length of 600 feet; raises made from one level to another for air; shaft 1150 feet deep from adit tunnel; several stopes, one being 300 feet long, 4 feet wide and 1100 feet high. Mine equipment consists of new hoisting plant (375 h.p., 2-reel drums), compressor plant, electric cars, shops and dwellings. Electric trains, consisting of ten cars (2200 pounds to a car), haul the ore from the mine to the mill. There are also 9 miles of power and 5 miles of telephone lines on the property. Reduction equipment consists of 30-stamp mill (electrically driven), nine concentrating tables and electroplating plant. All machinery operated with electric power from Northern California Power Company. Stamps weigh 1050 pounds and drop at the rate of 106 times per minute from a height of 6 inches. Mill crushes 100 tons in twenty-four hours, through a 40-mesh screen; 92% extraction is obtained. Tailings dumped into Clear Creek. Company employs 140 men, 40 on top, 90 in mine and 10 in mill. Property produced $3,000,000 since 1901. Original owners of this mine took out $80,000 in high grade. New hoist over shaft will have a steel gallows frame. About 70 gallons of water per minute is pumped with electrical pumps. American mine to the east.

Bibl.: Reports, VIII, pp. 568–569; X, p. 637; XI, p. 45; XII, p. 248; XIII, p. 357; U. S. Geol. Surv., Bull. No. 540, pp. 35, 37, 46, 57–60.

Golden Crown, consists of 80 acres, in Sec. 19, T. 31 N., R. 6 W., 2 miles northwest of Igo, in the Igo (South Fork) mining district. Owners, Dunham & Gilson. One vein 1 foot wide, syenite footwall and granitic-porphyry hanging. Short ore shoot, free milling. Prospect, only slightly developed. Little ore shipped to smelter. Idle.

Great Falls and Hope, consists of 100 acres, in Secs. 7 and 18, T. 31 N., R. 6 W., 4½ miles northwest of Igo, in the Igo (South Fork) mining district. Owner, Mrs. M. Ballou. Elevation 2100 feet. Four veins, three parallel, syenite footwall and granite hanging. Ore shoot 80 feet long and 2 feet wide, free milling. Workings consist of a tunnel on vein 520 feet long, short drifts and a stope. Little ore shipped. One man employed.

Gray Eagle, consists of 100 acres, in Sec. 10, T. 29 N., R. 10 W., 1 mile south of Harrison Gulch, in the Harrison Gulch mining district. Elevation 3000 feet. Owner, A. E. Johnson. One vein 12 inches wide, slate footwall and diabase hanging. Short ore shoot. Prospect.

Halcyon consists of 40 acres, in Sec. 17, T. 33 N., R. 7 W., 4 miles northeast of French Gulch in the French Gulch mining district. Elevation 2000 feet. Owner, C. L. Watson of French Gulch. Vein has a northeast and southwest strike and dips N. 80° W., slate footwall and tuff hanging. Ore shoot 80 feet long and 1 foot wide, free milling. Developed by means of a tunnel 400 feet long, 500 feet of drifts and 130-foot shaft. A little ore milled. One man working. Prospect.

Hardscrabble Mine (drift and hydraulic), formerly known as the *Piety Hill,* is located in Secs. 27, 34 and 35, T. 31 N., R. 6 W., ½ mile south of Igo, and consists of 1700 acres, patented. Owners, Happy Valley Land and Water Company, of Olinda. A. E. Bowles president. This company owns the old Dry Creek Tunnel and Flume Company's ditch, now known as Happy Valley ditch, which diverts water from the North Fork of Cottonwood, Eagle, Andrews and South Fork of Clear creeks. Course of channel is north and south, slate, sandstone and granite bedrock. Workings consist of old 1500-foot tunnel and several shafts 50 feet deep. Some of gravel 50 feet deep, average 20 feet. About 120 acres have been worked. Operated in the sixties by Alvinza Hayward as a drift and hydraulic mine. Has been a famous producer. Idle for several years. Water supplied to consumers through the old ditch.

Bibl.: Reports, XII, p. 249; XIII, p. 359.

Highland Mine, consisting of 60 acres, is located in Sec. 14, T. 33 N., R. 7 W., 2 miles northeast of French Gulch in the French Gulch mining district. Elevation 2800 feet. Owner, Highland Mining and Tunnel Company, of French Gulch; G. R. Simmons, superintendent. Strike of vein is north and south, dip 20° E., slate footwall and quartz-porphyry hanging. Pay shoot 250 feet long and 3 feet wide, free milling ore. Greatest depth on vein 400 feet in tunnel. Development work consists of several tunnels, 400 feet of incline shaft, drifts and stopes. Main tunnel is 1800 feet long on vein. Old 5-stamp mill is driven by water power; a ditch 3 miles long takes the water out of Clear Creek. Property said to have produced $100,000. Four men employed.

Bibl.: U. S. Geol. Surv., Bull. No. 540, p. 69.

Hope, in Sec. 8, T. 32 N., R. 7 W., 5 miles southwest of French Gulch, in the French Gulch mining district, consists of 60 acres. Elevation 1200 feet. Owners, M. Welch et al., of French Gulch. Ore shoot 100 feet long and 1 foot wide, free milling, slate walls. Workings consist of tunnel 480 feet long, 400 feet of drifts, one stope 80 feet long and 140-foot incline shaft. Rich ore on the surface was worked in arrastra. Idle.

Inez, consists of 120 acres, in Secs. 19 and 20, T. 32 N., R. 5 W., about ¾ of a mile south of Keswick. Owner, W. T. Lee. Ore shoot short. Ore free on the surface but base with depth. Workings consist of a 300-foot tunnel, 100-foot drift and several open cuts.

J. I. C., in Sec. 13, T. 33 N., R. 7 W., 3 miles northeast of French Gulch in the French Gulch mining district, consists of 40 acres. Elevation 2500 feet. Owner, V. Fox, of French Gulch. Strike of vein is northeast and southwest, dip N. 68° W., width 2 feet. Pay ore is found in pockets between slate walls. Workings consist of a tunnel 1000 feet long, 300 feet of drifts and 220 feet of incline shaft. Some rich ore found. Idle.

Bibl.: Reports, XII, p. 250; XIII, p. 360.

Jubilee, consists of 40 acres, in Sec. 23, T. 31 N., R. 6 W., ½ mile from Centerville. Owner, O. Westbrook, of Larkin. Five veins on claims, slate footwall and granitic-porphyry hanging. Pay shoot 100 feet long and 4 feet wide, free milling ore. Only slightly developed. One man working.

Kit Carson, consists of 100 acres, patented, in Sec. 3, T. 32 N., R. 5 W., 2½ miles southeast of Copley, in the Flat Creek mining district. Elevation 950 feet. Owners, Joshua Hendy Estate. Four parallel veins 3 feet wide, strike northeast and southwest, dip 50° E., granitic-porphyry footwall and slate hanging. Pay shoot 200 feet long and 3 feet wide, low grade. Workings consist of a 700-foot tunnel and 300 feet of drifts. Idle.

Laconia, in Sec. 1, T. 35 N., R. 6 W., 7 miles west of Delta and 1 mile east of Dog Creek Railroad, in the Dog Creek mining district, consists of 20 acres, in the Shasta Forest Reserve. Elevation 2000 feet. Three parallel veins, strike east and west, dip 40° S., meta-andesite footwall and quartz-porphyry hanging. Pay shoot 80 feet long and 3 feet wide. Short tunnels. Idle.

Liberty, consists of 240 acres, patented, in Secs. 31 and 36, T. 33 N., R. 5 and 6 W., 1½ miles northwest of Copley, in the Flat Creek mining district. Elevation 2000 feet. Owners, J. Chambers et al., of Redding. Three veins 2 feet wide, strike east and west, dip 65° N., quartz-porphyry walls. Pay shoot 220 feet long and 2 feet wide. Base ore.

Workings consist of a tunnel 1850 feet long, a 250-foot shaft and short drifts. Small producer at one time. One man employed.

Lodi, consists of 60 acres, in Sec. 16, T. 31 N., R. 6 W., about 3¼ miles north of Igo. Owners, W. D. Bull et al. Elevation 1400 feet. One vein 2 feet wide. Short ore shoot. Ore base below the surface, consisting of gold, silver, zinc and galena. Slightly developed with a short tunnel. Little ore shipped. Idle.

Bibl.: Reports, XII, p. 252; XIII, p. 361.

Lost Channel (drift) mine, consisting of 580 acres, is located in Secs. 3, 4 and 34, T. 30 and 31 N., R. 6 W., and extends southerly from the town of Igo for a distance of 1½ miles. Owner, C. A. Russell of Igo. The bedrock is soft, decomposed granite, slightly tilted. Course of channel is north and south, and contains some pay to a depth of 20 feet below the surface. Best values found 4 feet above bedrock. Workings consist of several tunnels, longest 1800 feet; also a number of old shafts 50 feet deep, all along Dry Creek. About 5 acres have been worked. Some of the gravel is rich. Gold is 875 fine, and sells for $18 per ounce. Leased by Porter & Thompson of Seattle, Wash., who endeavored to work the ground as a "dry land" proposition, using a shovel and then dumping the gravel into a rotary grinder, then running the tailings over a short copper plate. Experiment a failure. Power obtained from Northern California Power Company. Holdings now being drilled to determine dredging possibilities. Six men employed. Property has been a producer since 1865, when the first location (the Blue Bird) was made by T. White. Piety Hill drift mine to the northeast.

Mad Mule, formerly known as the *Banghart,* is located in Sec. 32, T. 33 N., R. 6 W., 5 miles northwest of Stella (by road), in the Shasta mining district. Holdings consist of 60 acres, located in 1887 and owned by the Mad Mule Mining Company of San Francisco; T. W. Briggs, superintendent. Two parallel veins exposed. Strike east and west, dip 30° N., slate footwall and meta-andesite hanging. Pay shoot 80 feet long and 16 inches wide. Four tunnels run on the veins, from 200 to 1000 feet in length. A tunnel is being run to obtain more depth on the ore body, four men being employed. Depth at present is about 250 feet. Surface sluiced off years ago and was rich. Best ore found near the footwall.

Bibl.: Reports IX, p. 38; XI, p. 396; XII, p. 252; XIII, p. 361; U. S. Geol. Surv., Bull. No. 540, pp. 40, 42, 52-54.

Mad Ox, consists of 80 acres in Sec. 32, T. 33 N., R. 6 W., 5 miles northwest of Stella. Owners, Caribou Gold Mining Company of Trinity Center. Elevation at tunnel 1800 feet. The vein has a strike of N. 30° E., dip S. 80° E., andesite forms both walls. Pay shoot 100 feet long and 14 inches wide, free milling. Worked to a depth of 150 feet. Four short tunnels and one shaft on the vein. Worked but little since 1911.

Bibl.: Reports, XI, p. 397; XII, p. 252; XIII, p. 361; U. S. Geol. Surv., Bull No. 540, p. 51.

Maduro, consists of 60 acres, in Sec. 20, T. 32 N., R. 5 W., 1 mile south of Keswick. Owner, W. Shattuck. Elevation 800 feet. Four parallel veins, but little developed. Only enough work done to hold the claims. Prospect. Idle.

McCall, consisting of 60 acres in the Shasta Forest Reserve, is located in Sec. 32, T. 36 N., R. 5 W., 7 miles southwest of Delta, in the Dog Creek mining district. Elevation 1600 feet. Owners, A. J. Kirk et al. One vein 3 feet wide, strike N. 50° W., vertical dip, granodiorite footwall and slate hanging. Pay shoot 80′ long and 27 inches wide, free milling. Four tunnels, about 60 feet apart, from 50 to 1200 feet long, and 400 feet of drifts constitute the development work. Little high grade shipped.

McKinnon, consists of 60 acres, in Sec. 6, T. 35 N., R. 5 W., 7½ miles west of Delta, and 1½ miles east of Dog Creek Railroad in the Dog Creek mining district, and in the Shasta Forest Reserve. Owner, A. McKinnon. One vein exposed, strike east and west, dip 70° N., 2 feet wide, granodiorite walls. Pay shoot 160 feet long and 2 feet wide, free milling. Three tunnels on the vein from 60′ to 750′ in length. Two men employed.

Midas, quartz mine, consisting of 550 acres, is one of the famous gold producers of Shasta County. It is located in Secs. 3, 4, and 10, T. 29 N., R. 10 W., some 52 miles southwest of Redding, by road, and in the Harrison Gulch mining district. The Victor Power and Mining Company has recently acquired this property. President, J. H. Sharp; secretary, P. H. Coffman; superintendent, A. L. Fletcher. Home office, Red Bluff. There are three known veins on the group—Gold Hill, Baldwin and Middle—strike N. 48° W., dip 75° S., average width 14 inches. There is considerable faulting, largest fault over 400 feet in width. The ore occurs in lenticular form, the pay shoots varying in length from 200 to 400 feet, width 14 inches, free milling. The Baldwin vein has been extensively worked. The development work consists of two double compartment shafts (6′ x 12′), one being 1400 feet deep, 14 levels, 26,000 feet of drifts, 11,000 feet of crosscuts, raises, stopes from 50′ to 300′ long, and tunnels from 50′ to 900′ in length. Stripping and filling method of mining used. Timber obtained from company's holdings and worked in sawmill some three miles from the mine. The mine equipment consists of two steam hoists and all necessary equipment such as cars, shops, tools and dwellings. Steam power used for hoisting throughout the year, while mill, pumps and compressor run on steam for seven months, balance of year by water power. The reduction equipment consists of a 20-stamp mill, 1000-pound stamps, six Frue concentrators and a new 100-ton cyanide plant, fine grinding with tube mill. Several thousand tons of tailings have been impounded ready for treatment. Company also owns 1200 acres of timber land. Number of men employed—top 25, mine 98, mill 4, total 127. Production for 1912—tons, daily 53, monthly 1597, for year 19,166. Percentage of extraction 76.83. Cost per ton 1912, development $1.86, mining $5.64, milling $0.58, general $1.07, total $9.15. The mine has been in active operation for the past twenty years and has produced several million dollars in gold. Victor mine to the east.

Milkmaid and Franklin, also known as the *Western,* has been a gold producer for many years, being one of the early discoveries in the French Gulch district. It is owned by the Western Exploitation Company, H. F. Musser, manager, and comprises 120 acres, consisting of the Milkmaid and Franklin groups, situated in Sec. 17, T. 33 N., R. 7 W., 3 miles by wagon road from the town of French Gulch. Elevation 1700 feet. Of the country rock, slate and granitic-porphyry form the hanging and footwall respectively. Two veins have been followed in the Franklin workings, one with a N. 5°–30° W. strike and a dip of 75° E., the other strikes W. The intersection of the two veins has not been discovered. The vein with the northward strike is in the western part of the workings and has been stoped for 70 feet on the main level. The other vein has been followed for 700 feet on the main level. The maximum width is 4½ feet, average 16 inches, but narrows down to a seam in places. The ore consists of ribbon quartz, carrying pyrites, and is free milling. The workings on the Franklin consist of a main adit about 1300 feet long, and two shorter levels, connected by a raise on the vein and a 130-foot winze connecting the main level with the old level, also drifts and stopes, totaling several hundred feet of development work. Stopes as a rule are filled with waste.

The Milkmaid, which adjoins the Franklin on the east, has not been worked recently, but has been a producer in the past. One vein has a strike of N. 30° E., dip vertical, and has been developed with tunnels, drifts and stopes, also a 400-foot incline shaft sunk at an angle of 45°. Ore was rich and free, but the vein was small. The mine equipment consists of cars, tools, shop and dwellings. The reduction equipment consists of a new 10-stamp mill on the Milkmaid group. The operating power, electricity, is obtained from the Northern California Power Company. The stamps weigh 1100 pounds each, and drop at the rate of 102 times per minute for a distance of 6 inches, the ore being crushed through a 40-mesh screen and thence conveyed to four Frue vanners. Fourteen men employed. Considerable ore extracted by lessees in former years. Production in last five years about $350,000. Property adjoins the old Washington mine.

Bibl.; U. S. Geo. Surv., Bull. No. 540, pp. 35, 61, 63, 64.

Minnesota, in Secs. 1 and 2, T. 32 N., R. 6 W., 2 miles southwest of Copley, in the Flat Creek mining district, consists of 100 acres, patented. Owner, J. W. Parmalee. Five veins on the claims, four parallel, diorite footwall and granitic-porphyry hanging. Work confined to one vein having a strike of N. 40° E., dip 35° N. Pay shoot 150 feet long and 4 feet wide, free milling. Workings consist of a tunnel 1900 feet long, 1000 feet of drifts, raises, and a stope 150 feet long. Old 10-stamp mill idle. Producer at one time. Two men employed.

Mount Pleasant consists of 80 acres, in Sec. 32, T. 32 N., R. 5 W., 1 mile west of Redding, in the Shasta mining district. Owners, H. C. Cummings et al. Elevation 900 feet. Vein has a northwest and southeast strike and dips 45° E., slate footwall and quartz-porphyry hanging. Pay shoot 140 feet long and 3 feet wide, free milling. Workings consist of a tunnel 500 feet long and short drifts. One man employed.

Mount Shasta, one of the quartz producers of this county, is located in Sec. 33, T. 32 N., R. 6 W., about 3 miles south of the town of Stella. Owner, Mount Shasta Mining Company, of San Francisco; G. M. Vail, superintendent. The holdings consist of 120 acres, which were acquired from George Leversay, by the Mount Shasta Gold Mines Corporation. This corporation failed in 1905 and the mine was idle until 1911, when it was secured by the present owners. Elevation 2200 feet. There are two parallel veins on this group about 50 feet apart, strike N. 40° W., dip 40°–50° S., quartz-diorite footwall and granitic porphyry hanging. Pay shoot 400 feet long and 12 feet wide, low grade, free milling. Development work consists of a shaft 465 feet deep, seven levels, 300-foot drift on the seventh level, several stopes and short tunnels. Mine equipment consists of cage, wooden gallows frame, steam hoist, dwelling, etc. The 8-stamp mill, steam driven, is idle. Stamps weigh 1050 pounds each. Some ore blocked out. Four men working.

Bibl.: U. S. Geol. Surv., Bull. No. 540, pp. 39, 44, 46, 47–48.

Morton & Bliss, formerly known as the *Riley & Bliss,* consists of 100 acres, patented, in Sec. 1, T. 33 N., R. 6 W., 6½ miles west of Kennett, in the Backbone mining district. Owner, Bliss Estate, of New York. Elevation 2600 feet. Two parallel veins 3 feet wide, strike northeast and southwest, dip 40° E. Pay shoot 200 feet long and 3 feet wide, free milling. Workings consist of two tunnels on the vein 380 to 2400 feet long, 500-foot drift, raise and stope 200 feet long. Old 10-stamp mill idle. Stamps weigh 850 pounds each. Mill can be operated both with steam and water power, water from South Fork of Squaw Creek. Property has been a producer, but idle at present.

Murray consists of 120 acres, in Sec. 18, T. 32 N., R. 5 W., 1½ miles north of Keswick. Elevation 1000 feet. Owners, Mount Shasta Mining Company. H. C. Cummings, of Redding, manager. Vein about 6 feet wide, strike N. 40° E., dip 50° S. Pay shoot about 230 feet long, 6 feet wide, quartz-porphyry footwall and syenite hanging. Ore free milling but low grade. Developed by means of a tunnel 530 feet long, 200-foot drift and one short raise. Four men working. Small producer at one time.

Bibl.: Reports XII, p. 243; XIII, p. 362.

Nellie and *Annie,* consists of 80 acres in Secs. 1 and 2, T. 33 N., R. 7 W., 5 miles north of French Gulch, in the French Gulch mining district. Elevation 3200 feet. Owners, M. Welch et al., of French Gulch. The vein has an east and west strike and dips 60° S., slate footwall and granite-porphyry hanging. Pay shoot 230 feet long and 2 feet wide, ore free milling. A tunnel 340 feet long, and short drifts constitute the development work. A little production by lessees.

New York and *Skylark,* consisting of 60 acres, is located in Sec. 17, T. 33 N., R. 7 W., 4 miles northwest of French Gulch, in the French Gulch mining district. Elevation 2800 feet. Owner, W. Richards. Two parallel veins about 200 feet apart strike east and west, dip 60° N., slate walls. Ore shoot 180 feet long and 5 feet wide, low grade, free milling. Workings consist of a tunnel on the vein 340 feet long, a 40-foot winze and 1 stope. Production record small. Idle.

Niagara, formerly known as *Black Tom,* was at one time one of the famous quartz producers of the French Gulch mining district, but has been idle since 1905. This group, consisting of 410 acres, patented, is located in Secs. 1, 6, 7, 8, 15 and 18, T. 33 N., R. 7 W., about 4½ miles by road from French Gulch. Elevation 2800 feet. It is on the same hill as the Washington mine, and the claims were located in 1857. Owners, W. W. Bunzoine et al., of French Gulch. The vein system is not well defined. The main veins, two in number, one on the Niagara, and the other on the Scorpion claims, have been worked. The strike is northeast and southwest, dip N. 70° W., footwall is granitic-porphyry and hanging-wall is slate. The ore is free-milling with some pyrites. Ore shoot 200 feet long and 3 feet wide. Workings consist of six tunnels, four being crosscuts from 150 to 2200 feet in length, 2000 feet of drifts, several stopes and raises. Tunnel on Niagara claim is 1662 feet long. The reduction equipment consists of four old stamp mills, 18 stamps in all, steam driven. Mine said to have produced over $1,000,000 in gold. Maximum depth about 500 feet. Said to be on the same lead as the Washington mine.

Bibl.: Reports X, p. 636; XI, p. 50; XII, p. 253; XIII, p. 263. U. S. Geol. Surv., Bull. No. 540, pp. 35, 37, 44, 67.

North Star consists of 60 acres, in Sec. 18, T. 31 N., R. 6 W., 4 miles northwest of Igo, at an elevation of 1600 feet. Owner, J. W. George. One vein in syenite and slate, but slightly developed, short ore shoot, little high grade extracted. Idle. Prospect. Mentioned in our Report XIII.

Bibl.: Report XII, p. 253.

Old Spanish, formerly known as *Deakin & Taylor,* and as *Enright,* is located in Sec. 31, T. 32 N., R. 5 W., 2 miles west of Redding. Owner, J. Sallee. Holdings consist of 60 acres, at an elevation of 800 feet. Vein 5 feet wide, strike north and south, dip 45° E., slate walls. Pay shoot 140 feet long and 5 feet wide, low grade, free milling. Workings consist of a 460-foot tunnel, 600 feet of drifts and 1 stope. Old 4-stamp mill. Idle. Property a producer at one time.

Bibl.: Report XII, p. 246.

Olive, consisting of 80 acres, is located in Sec. 19, T. 32 N., R. 5 W., 1½ miles southwest of Keswick. Elevation 1100 feet. Owner, Wright Estate. Three parallel veins, granite footwall and schist hanging. Pay shoot 230 feet long and 6 feet wide, low grade, free milling. Old 4-stamp mill idle. Small producer several years ago.

Oro Fino consists of 60 acres in Sec. 34, T. 32 N., R. 6 W., ½ mile east of old town of Shasta. Elevation 1200 feet. Owner, C. H. Berhrens. Two parallel veins, quartzite footwall and hornblende hanging, east and west strike, and a dip of 60° S. Pay shoot 200 feet long and 2 feet wide, ore free milling. Only slightly developed by means of three tunnels on vein, longest 700 feet. One man working.

Bibl.: Report XI, p. 44.

Oro Vista, in Sec. 36, T. 32 N., R. 6 W., ½ mile southeast of old town of Shasta, consists of 60 acres. Elevation 1600 feet. Owner, N. D. Fowler. Three parallel veins, strike east and west, dip 85° N. Pay shoot 170 feet long and 4 feet wide, low grade, free milling. Workings consist of a tunnel 530 feet long, and short drift. Two men employed.

Potosi consists of 60 acres, patented, in Sec. 15, T. 31 N., R. 6 W., 1½ miles northwest of Centerville, in the Igo mining district. Elevation 1000 feet. Owner, E. P. Jones. One vein, slate footwall and granitic-porphyry hanging. Pay shoot 100 feet long and 1 foot wide; some high grade extracted. Short tunnel and 90-foot shaft comprise the workings. Idle.

Bibl.: Reports XII, p. 254; XIII, p. 363.

Princess (drift and hydraulic) mine consists of 300 acres, patented, in Secs. 25 and 26, T. 31 N., R. 6 W., 1 mile south of Centerville. Owner, I. Baer. Course of channel is northeast and southwest, granite bedrock; depth of gravel, 30 feet. About 40 acres worked. Workings consist of an old tunnel on bedrock 600 feet long, drifts and old shafts 50 feet deep. Water supply was obtained from Boulder Creek through a ditch 12 miles long. Owner had a permit from the debris commission, granted in 1901, to operate, but the retaining dam was condemned and the property has been idle since that time. Chapman & Voluntine hydraulic mine to the northeast.

Red Hill (drift and hydraulic) mine, formerly known as *Gardner Bros.,* consists of 60 acres, in Sec. 1, T. 30 N., R. 7 W., ½ mile northeast of town of Ono. Owners, M. Gardner et al., of Ono. Course of channel northeast and southwest; soft granite bedrock, gravel 20 feet deep. Water obtained from Eagle Creek through a ditch 2 miles long. Formerly worked as a hydraulic mine, but on account of the debris law it is operated by drifting. In operation during the winter months. Small producer.

Bibl.: Reports XII, p. 255; XIII, p. 363.

Reid, in Sec. 3, T. 32 N., R. 5 W., 2 miles southeast of Copley, in the Flat Creek mining district, consists of 140 acres. Owner, J. M. Selnave. Elevation 1900 feet. Three parallel veins, strike N. 40° E., dip 35° E. Pay shoot 200′ long and 2′ wide, free milling. Bonded to Geo. Bayha. Two men working.

Ruby and Pearl consists of 100 acres, in the Shasta Forest Reserve, in Sec. 4, T. 38 N., R. 5 W., 6 miles north of Castella. Owner, J. Wall. Elevation 5500 feet. One vein, strike northwest and southeast, dip 40° E., granite walls. Pay shoot 80 feet long and 1 foot wide, ore free milling. Developed by means of one tunnel 400 feet long on vein, and short drifts. Bryan mill, capacity 5 tons daily. Idle. Small producer.

Sam Houston, in Sec. 34, T. 33 N., R. 5 W., about 2 miles east of Copley, in the Flat Creek mining district, consists of 80 acres. Elevation 1000 feet. Owners, Sam Houston Mining Company of San Francisco. Three veins, quartz-porphyry walls. Pay shoot short, similar to the Garfield prospect. A little ore in sight. Idle.

Scottish Chief consists of 120 acres, patented, in Sec. 31, T. 33 N., R. 5 W., ½ mile northwest of Copley, in the Flat Creek mining district.

Elevation 900 feet. Owner, W. Menzel. One vein 2 feet wide, strike northwest and southeast, dip 75° E., granite walls. Pay shoot 80 feet long and 2 feet wide, free milling ore. Workings consist of a tunnel on vein 800 feet long, drift and stope. Old 3-foot Huntington mill. Idle. Small producer at one time, but the property has not been worked recently.

Shasta Dredging Company, operating on the old Quinn ranch, owns 400 acres of land along Clear Creek, in Secs. 31 and 32, T. 31 N., R. 5 W., about 4 miles southwest of Redding, in the old Horsetown district. This property was operated for a time by the California and Detroit Mining Company, but their suction dredge proved a failure and the present owners acquired the holdings in 1902. A. S. Newsome, president; W. A. Palmer, manager; and J. Heaton, superintendent of dredge for the company. Home office, San Francisco. The course of the channel is east and west, slate and sandstone bedrock tilted. Pay gravel about 20 feet deep. About 100 acres have been worked. Dredge equipped with 5-cubic foot buckets and 6′ x 30′ screens. Power from Northern California Power Company. Boat handles about 60,000 cubic yards per month. Twelve men employed. Three new hulls have been built by present company. Ground worked in the early days with rockers and was rich.

Bibl.: Bull. No. 57, p. 216.

Silver Falls, formerly known as *South Fork,* consists of 240 acres, in Sec. 20, T. 31 N., R. 6 W., 2 miles northwest of Igo. Owners, Silver Falls Mining Company, of Redding; H. Rogers, president. Eight veins on the claims, granite walls. Workings consist of 600-foot tunnel and drifts. Two men working. Small producer. Atlantic to northeast.

Siskiyou and Nightingale consists of 40 acres in the Shasta Forest Reserve, in Sec. 2, T. 35 N., R. 6 W., 7 miles west of Dog Creek Railroad, in the Dog Creek mining district. Elevation 2200 feet. Owners, Glenn County Mining Company; home office, Millsaps; Geo. Millsaps, president; A. Luce, secretary. Five veins on the claims. Strike of main vein east and west, dip vertical, slate footwall and andesite hanging. Pay shoot 450 feet long and 3 feet wide, free milling. Workings consist of five tunnels on vein from 100 to 500 feet long and four drifts. Two men employed. Active development work to be pursued. Delta Consolidated to north and Trinity Consolidated to south.

Slattery & Welch (hydraulic) mine consists of 30 acres, in Sec. 8, T. 33 N., R. 6 W., about 5 miles northeast of French Gulch, in the French Gulch mining district. Owners, Slattery & Welch, P. J. Slattery, superintendent. Course of channel northeast and southwest. Pay gravel from 5 to 10 feet deep. Water obtained from Clear Creek and

Klines Gulch through a ditch 3 miles long. Only worked for a short time during the winter season. Some coarse gold found. Small producer.

Slide consists of 100 acres, patented, in Secs. 7 and 8, T. 32 N., R. 5 W., 1 mile north of Keswick. Owner, J. McCreary. Pay shoot 110 feet long and 2 feet wide, free milling, granitic-porphyry walls. Workings consist of a tunnel on vein 700 feet long and 600 feet of drifts. Two men working. Prospect.

Summit and Montezuma, midway between the Brunswick and Niagara mines, is located in Sec. 17, T. 33 N., R. 7 W., 5 miles west of French Gulch, in the French Gulch mining district. Elevation 4200 feet. Holdings consist of 60 acres, patented, under lease to Allen & Alexson. Property owned by Porter & Wheeler Estate, of Redding. Two parallel veins on this group, strike northeast and southwest, dip 70° N. Ore shoots are short and 8 inches wide, free milling, some high grade found, a 3-ton lot giving returns of $423 per ton in gold. Workings consist of three adits about 40 feet apart, 200-foot drift and a stope 40 feet long. The lessees have the ore milled at the Washington mill.

Bibl.: Report X, p. 641; U. S. Geol. Surv., Bull No. 540, pp. 35, 37, 44, 67.

Sunday Gulch, a recent location, consists of 300 acres, in Sec. 10, T. 29 N., R. 10 W., 3 miles southeast of Harrison Gulch. Owners, Victor Mining Company; J. H. Sharp, president; A. L. Fletcher, superintendent. Four parallel veins, strike N. 70° E., dip 45° S., main vein is 4 feet wide and gave returns in places, on the surface, of $8 per ton in gold, slate footwall and diabase hanging. Prospect, just being developed by means of short tunnels. Two men employed.

Sunny Hill, formerly known as *Summit* and *Gray Eagle,* consists of 100 acres in Sec. 1, T. 30 N., R. 8 W., about 7 miles west of Ono, in the Ono mining district. Owner, M. Mariscano, of San Francisco. One vein 1 foot wide, strike north and south, dip vertical, hornblende schist footwall and granitic-porphyry hanging. Pay shoot 80 to 100 feet long, ore free milling. Workings consist of tunnel 530 feet long, 300 feet of drifts and one stope. Elevation at tunnel 4500 feet. Reduction equipment consists of two 5-foot Huntington mills run by water power; water from Jerusalem Creek. Producer at one time; some high grade ore found. Two men employed.

Bibl.: Reports XII, p. 257; XIII, p. 365.

Tanglefoot, consists of 60 acres in Sec. 12, T. 30 N., R. 8 W., about 8 miles southwest of Ono. Owner, W. M. Lee. Two parallel veins about 200 feet apart, strike N. 40° W. dip 50° E. Pay shoot 60 feet long and 10 inches wide; free milling; some high grade ore extracted. Only slightly developed with a tunnel 450 feet long. Idle.

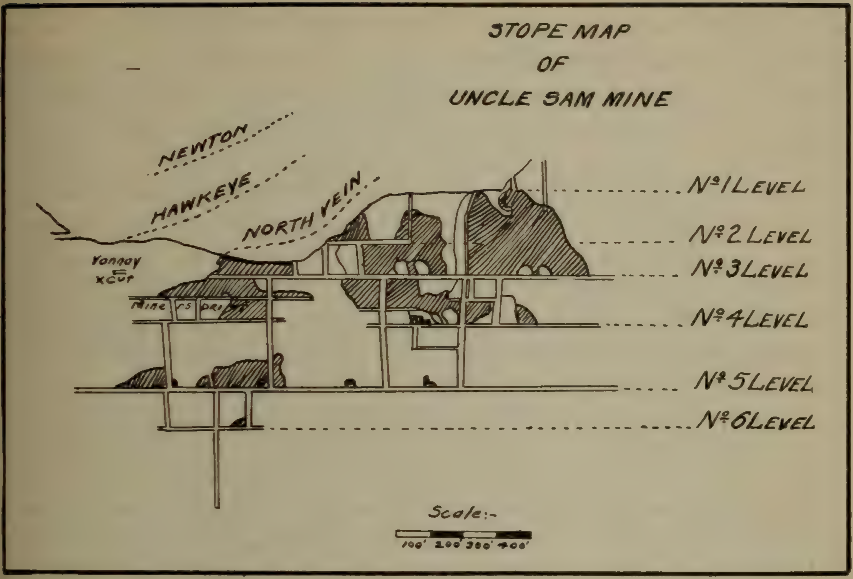
Texas Consolidated, one of the old gold producers of Shasta County, is located in Secs. 32 and 33, T. 33 N., R. 5 W., about 1 mile east of Copley, in the Flat Creek mining district. The holdings consist of 220 acres, patented; elevation 1800 feet. Owned by the Texas Consolidated Mining Company, C. E. Jarvis, president. Home office, Cleveland, Ohio. There are four known veins on this group. The main vein has a N. 50° E. strike and dips 70° E., width 4 feet, quartz-porphyry walls. Pay shoot 340 feet long and 4 feet wide, ore free milling. The development work consists of a tunnel on the main vein 4000 feet long, several thousand feet of drifts, raises and stopes. The mine equipment consists of all necessary machinery, shop and dwellings. The reduction equipment consists of a 20-stamp mill, driven by electricity; eight Triumph concentrators, and an old 3-ton chlorination plant, all idle. Power obtained from Northern California Power Company. Mine under lease to Geo. Bayha. Four men employed. Some ore in sight.

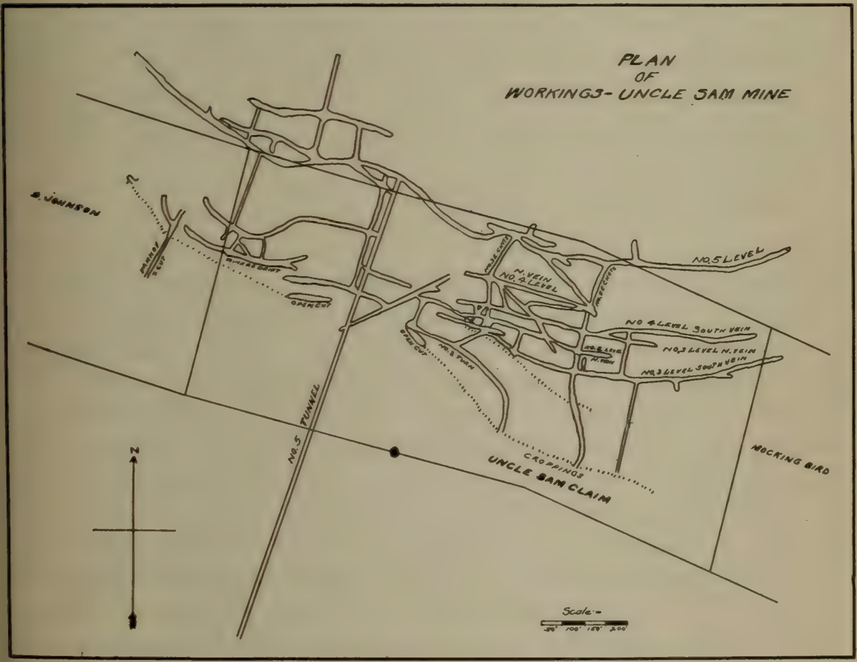
Bibl.: Reports X, pp. 629, 630; XI, pp. 43, 395-397; XII, p. 258; XIII, p. 365.

Three Sisters, consisting of 60 acres, patented, located in Sec. 15, T. 33 N., R. 7 W., 2 miles northwest of French Gulch, in the French Gulch mining district, elevation 1700 feet. Owned by Ellery et al., of French Gulch. Three veins on the claims carrying rich ore in spots. One pay shoot is 200 feet long and 18 inches wide, between granitic-porphyry walls. Workings consist of a tunnel 1350 feet long on the vein, 800 feet of drifts, a stope 200 feet long and a winze 120 feet deep; ore free milling. The 3½-foot Huntington mill, steam driven, is idle. Property has been a producer, but has been worked in only a small way since 1905.

Bibl.: Report XIII, p. 367; U. S. Geol. Surv., Bull. No. 540, p. 69.

Tom Green, adjoining the Brunswick mine on the west, is locate in Sec. 15, T. 33 N., R. 7 W., 5½ miles west of French Gulch, in th French Gulch mining district. The holdings, consisting of 80 acres located in 1887, elevation 4400 feet, are owned by J. E. Francks et al. of French Gulch; leased to W. P. Hight. Three parallel veins, bu only one has been worked, strike north and south, dip 45° E., granitic porphyry footwall and slate hanging. Ore shoot 210 feet long and feet wide; ore is free milling. Workings consist of a tunnel on th vein 1900 feet long, drifts, stopes and a raise 80 feet in height. Ol 10-stamp mill, steam driven, is idle. Worked by lessees since 190 Three men employed. Small producer.


STOPE MAP
OF
UNCLE SAM MINE
NEWTON
HAWKEYE
NORTH VEIN
Yonnay
X Cut
Miners Drift
Nº 1 LEVEL
Nº 2 LEVEL
Nº 3 LEVEL
Nº 4 LEVEL
Nº 5 LEVEL
Nº 6 LEVEL
Scale:-
100' 200' 300' 400'


PLAN
OF
WORKINGS- UNCLE SAM MINE
S. JOHNSON
Miners Drift
OPEN CUT
N. VEIN
NO. 4 LEVEL
NO. 5 LEVEL
NO 4 LEVEL SOUTH VEIN
NO. 3 LEVEL N. VEIN
NO. 3 LEVEL SOUTH VEIN
N. VEIN
OPEN CUT
NO. 5 TUNNEL
CROPPINGS
UNCLE SAM CLAIM
MOCKING BIRD
N
Scale:-
50' 100' 150' 200'

Trinity Consolidated, consisting of 120 acres, patented, elevation 2400 feet, is located in Secs. 1 and 2, T. 35 N., R. 6 W., west of Delta, and 1½ miles west of D. C. R. R., in the Shasta Forest Reserve. Owner, Alden Anderson of Sacramento. Eight veins on the group, six being parallel, strike of parallel veins east and west, dip vertical, slate footwall and meta-andesite hanging, width 3 feet. Pay shoot 450 feet long and 3 feet wide, free milling ore. Workings consist of several tunnels on the vein from 50 to 450 feet long, drifts, raises and stopes. Maximum depth 160 feet. Reduction equipment consists of a 10-stamp Hendy mill, built in 1900; stamps weigh 1100 pounds. Mill operated by both steam and water power, water being obtained from Dog Creek through a ditch 1 mile long. Property has been a small producer. It is on the same lode as the Delta Consolidated. Advance group to the north and Siskiyou to the northeast. Idle at present.

Bibl.: Reports XIII, p. 367; U. S. Geol. Surv., Bull. No. 540, pp. 35, 37, 54, 55.

Truscott, formerly known as the *Emigrant,* consists of 40 acres in Sec. 25, T. 32 N., R. 7 W., about 6 miles northwest of Stella. Owner, John Martin, of San Francisco. Elevation at main tunnel 2600 feet. Two veins on the claims; the main vein has a strike of N. 20° E., dip 70° W.; the other vein is small and crosses the main vein at a slight angle, slate footwall and andesite-porphyry hanging. Pay shoot 100 feet long and from 5 to 10 feet wide, free milling, low grade. Development work consists of four tunnels 40 feet apart on the vein, from 50 to 610 feet in length, drifts and stopes. Property has been a producer. Two men working.

Bibl.: Report XII, p. 248.

Uncle Sam, one of the noted quartz mines of this county, is located in Sec. 1, T. 33 N., R. 6 W., 6 miles west of Kennett, in the Backbone mining district. Elevation 2300 feet. Present owners are the Dakin Company, of San Francisco, who control 140 acres of patented mineral ground. The mine was discovered in 1886 by J. Conant, who sold it to Dakin and his associates, and after working the property for a time it was acquired by the Sierra Buttes Mining Company. This company operated the mine for several years, producing over $1,000,000 in gold, from a maximum depth of 450 feet. A wagon road connects Kennett, a town on the Oregon Branch of the Southern Pacific Railroad, with the mine. Several veins, only one of which has been worked, strike N. 80° W., dip 55° NE., width 4 feet. Lode can be traced on the surface for 2000 feet. Ore is free milling. The development work consists of five tunnels, four on the vein, from 50 to 3000 feet long, one crosscut 400 feet long, drifts, raises and stopes (see map). The mine equipment is complete; compressor plant destroyed by fire in 1913. The reduction plant consists of a 20-stamp mill, four Frue vanners, old canvas and chlorination plants. Mill operated by electricity from Northern California Power Company. Stamps weigh 850 pounds each. Property operated for a time by a Portland company on a lease. Idle since May, 1913. Some ore blocked out. New ore shoot recently discovered.

Bibl.: Reports X, p. 639; XI, pp. 47, 395, 398; XII, p. 258; XIII, p. 367.

Utah and California, also known as the *Walker,* is located in Secs. 3 and 4, T. 32 N., R. 5 W., 2 miles southeast of Copley, in the Flat Creek mining district. Holdings consist of 270 acres, elevation 800 feet. Owned by Walker Bros., of Salt Lake City, Utah. Five veins on the group. Main vein has a north and south strike and dips 80° E., quartz porphyry walls. Pay shoot 300 feet long and 5 feet wide, low grade, free milling. Workings consist of a tunnel 2300 feet long on the vein, several thousand feet of drifts and stopes. Reduction equipment consists of 10-stamp mill and four Frue vanners, steam driven. Stamps weigh 1000 pounds each. Producer at one time. Idle.

Bibl.: Reports X, pp. 630-631; XII, p. 259; XIII, p. 368.

The Victor, adjoining the Midas mine on the east, consists of 250 acres, in Sec. 3, T. 29 N., R. 10 W., in the town of Harrison Gulch, in the Harrison Gulch mining district. Elevation at mine shaft 2600 feet. Owners are the Victor Power and Mining Company, J. H. Sharp, president; P. H. Coffman, secretary; A. L. Fletcher, superintendent; R. D. Jackson, consulting mining engineer. Home office, Red Bluff. Two veins on the group, known as the Baldwin and Gold Hill, strike N. 50° W., dip 75° SW., diabase walls, average width of veins 2 feet. Pay shoot 300 feet long and 2 feet wide. Ore free milling. Several faults, one being 400 feet wide. The development work consists of a shaft (4′ x 9′) which is 400 feet deep, five levels, 800 feet of drifts, 960-foot crosscut, raises and one stope 300 feet long. Shaft sunk on a 45° incline. The mine equipment consists of three distillate engines (15, 32 and 50 h.p.), hoist, 50-foot gallows frame, compressor, pumps, shop, dwellings. Reduction equipment consists of a 3-stamp Nissen mill and two Frue concentrators. Stamps weigh 1300 pounds each. Plant operated with distillate, costing 19¢ per gallon; use 100 gallons per day. Seven men employed. Property a small producer at present. The wagon road from Redding to Harrison Gulch passes through the Victor claim. Workings confined mainly to the Victor claim.

Washington, located in 1852, was the first quartz location in Shasta County and is one of the oldest mines in California. At one time it was the largest producer in the French Gulch mining district. The holdings consist of 82 acres in Secs. 16 and 17, T. 33 N., R. 7 W., 3 miles northwest of French Gulch. Elevation 2300 feet. Owners, Washington Gold Mining Company, of Redding: C. L. Watson, manager. Leased to Maxwell & Ketch. Two veins about 60 feet apart have been worked; one has a north and south strike, with a dip of 70° E. and has been worked only near the surface; the other has an east and west strike, with a north dip, and has been worked to a depth of 500 feet. The north and south vein seems to cut off the other. The east and west lead pinches in places and at times widens to 10 feet, being in a well-defined fault plane. The footwall is granitic porphyry and the hanging slate; ore is free milling. The workings consist of six tunnels from 300 to 2400 feet long, drifts, raises and stopes, comprising in all several thousand feet. The main tunnel caved in many places. One stope is said to be 400 feet long, 5 feet wide and 250 feet high. The reduction equipment consists of an old 10-stamp mill and two vanners; stamps weigh 850 pounds each. Custom ore treated in this mill. Mine said to have produced over $2,000,000. The first mining operations consisted in sluicing the rich and decomposed material on the outcrop. Some of the oxidized ore was rich, running at times over $600 per ton in free gold. Three men employed by the lessees. Milkmaid to the south.

Bibl.: Reports X, pp. 635-636; XI, p. 50; XII, p. 260; XIII, p. 368; U. S. Geol. Surv., Bull. No. 540, pp. 35, 37, 44, 64-66.

GRANITE.

The granite in Shasta County is generally of a light color, containing some hornblende and shows the effect of strong pressure, as the rock, when not decomposed, is much jointed and cross-jointed. It is not much used for building or monument purposes on account of fracture planes and quartz seams cutting through the rock.

Bibl.: Bull. No. 38, p. 53.

Masterton Quarry, consisting of 60 acres, is located in Sec. 20, T. 32 N., R. 6 W., about 1½ miles south of Stella. This deposit is very massive. Only the boulders are worked. Used for curbing and coping. Idle at present.

Jewel Quarry is located in Sec. 25, T. 31 N., R. 6 W., 2½ miles east of Igo. Massive deposit. Rock grayish in color and similar to Masterton deposit. It has not been worked for several years.

INFUSORIAL EARTH.

Several exposures of infusorial earth, locally called "chalk," are found in the northeastern part of this county, but more especially along both banks of the Pit River, near the mouth of Hat Creek, and up that creek for about 5 miles. Only a relatively small part of these beds is pure, the greater portion being mixed with sand. The beds are seldom over 10 feet thick and are interbedded with tuffs and basaltic debris. These exposures are especially prominent in Secs. 7, 17 and 18, T. 36 N., R. 4 E., M. D. M.

Bibl.: Bull. No. 38, pp. 296, 363.

IRON ORE.

The most prominent deposits of iron ore are found in close proximity to the McCloud Carboniferous limestones on both sides of the Pit River. There are also extensive surface indications of iron ore bodies, north of Pit and east of McCloud rivers.

Bibl.: Reports II, p. 195; IV, pp. 236, 259; Bull. No. 38, pp. 301–304. J. S. Diller, U. S. Geol. Surv., Bull. 213, pp. 130, 219, and Bull. No. 225, p. 178.

Noble Electric Steel Company, formerly known as *Shasta Iron Company,* owns 320 acres in Sec. 25, T. 34 N., R. 3 W., M. D. M., about 5 miles east of Pit. The Sacramento Valley and Eastern Railroad connecting Pitt, a station on the Oregon branch of the Southern Pacific Railroad, with the Bully Hill mine, passes through a portion of these holdings. John Crawford is superintendent for the Noble Electric Steel Company; home office, San Francisco. The iron ore lies between quartz-diorite and limestone (McCloud). The deposit is large and massive, consisting of iron oxide and magnetite, and is worked as a quarry, the ore being shot down and conveyed to the smelter a distance of ½ mile by means of an automatic tramway.

The method of treatment consists in retorting the ore in an electric smelter, using charcoal and carbon, electrically heated, thus igniting the charcoal, which is used as a means of reducing the ore. The carbons, two in number, are 6 feet long and 6 inches in diameter. No stack on the retort, as draft is obtained by means of blowers. A proper charge (charcoal, barren quartz and limestone fluxes) is charged simultaneously with the ore, so the whole is well mixed by the time it reaches the smelting zone. Tap furnaces three times and run the ore into sand pig beds. When it has cooled down so that it will not "bleed," the sow with its attendant pigs is lifted from each bed by grab-hooks and carried on a traveling crane. The iron is broken up by a drop, lifted by a magnet and transferred to the platform scales, where it is weighed. From here it is stacked according to grade, grading altogether by silicon content, as sulphur and phosphorus are very low. Grades run from No. 1 silicon, containing 4.5%–5% silicon, to foundry low with 1%–1.25% silicon. The iron is tougher, finer grained, and has a more homogeneous fracture than other charcoal irons. Daily production about 25 tons.

The furnaces are long and narrow, consisting of rectangular shell 25′ long, 10′ wide and 8′ high, battered four ways at the bottom to form a crucible. The portion above the bottom corresponds to the back or smelting zone of the blast furnace. The shell, lined with standard furnace brick, supports five charging stacks 18 feet high, and between these are suspended four electrodes which penetrate vertically into the charge. Electricity obtained from Northern California Power Company. Twelve men employed at present. Lime is also manufactured.

LIMESTONE.

Three parallel belts of limestone, having a general north and south strike, occur in the western half of this county. The most eastern belt is found on Cedar Creek, east of the Afterthought mine in the southern portion of T. 34 N., R. 1 and 2 W., and in Secs. 7 and 8, T. 34 N., R. 2 W., the furance flux for the Bully Hill mine coming from the latter sections. Another belt is found in Sec. 26, T. 33 N., R. 4 W., and can be traced for many miles, forming the McCloud bluffs, near the United States Fisheries. The most western belt crops out east of the Sacramento River in the northern part of the county, and is again found west of Kennett, on the south side of the divide between the two Backbone creeks. This deposit has been more extensively worked than any of the others, and is of good quality.

Bibl.: Diller, U. S. Geol. Surv., Bull. No. 196, p. 94; Bull. No. 213, p. 365; Bull. No. 225, p. 176. State Mining Bureau Bull. No. 38, pp. 88–91, 366; Vol. I of Paleontology of California, Whitney; Report XI, pp. 35-40.

Holt & Gregg Quarry is located in Sec. 32, T. 34 N., R. 5 W., and consists of 120 acres, patented, about 2 miles northwest of Kennett, on the south slope toward Little Backbone Creek, at an elevation of 2000 feet. This excellent limestone deposit, on the western belt, is owned by Holt & Gregg, of Redding; F. M. Kindelberger, superintendent. Quarrying method of mining used. The limestone is hauled to the kilns at Kennett, a distance of 2 miles, by means of an electric railway, power being obtained from the Northern California Power Company (see photo No. 7). The crude material is roasted in three Hoffman continuous kilns, crude oil being used for fuel. Lime removed every two hours. Output is 25 tons in twenty-four hours. Product is of an excellent grade and sold extensively throughout California. Thirteen men employed.

MACADAM.

The macadam used for the streets of Redding comes from the *Redding Municipal Quarry,* located in Sec. 29, T. 32 N., R. 5 W., 1 mile northwest of this city. The holdings consist of 30 acres, patented. The quarry work is under the direction of the superintendent of streets. The rock is altered, siliceous in character, and igneous in origin. The deposit is massive and easily worked. The equipment consists of a 300-ton ore bin, a rotary crusher of 250 tons capacity, air compressor, four machine drills, ½ mile of narrow gauge track and ore cars, all operated by electric power from Northern California Power Company. Only worked upon demand.

Photo No. 7. Holt & Gregg Lime Plant, Kennett.

Bibl.: Bull. No. 38, p. 324.

MANGANESE.

Manganese is reported on land owned by the Shasta Copper Company (Furber, White et al., of Redding), in Secs. 1 and 36, T. 33 and 34 N., R. 4 W., near Heroult. A shaft 30 feet deep constitutes the development work. Analysis of some of the ore shows:

20.00% manganese.
34.00% silicon.
6.72% iron.
$1.65 per ton in gold.

MARBLE

Marble is found in Sec. 3, T. 33 N., R. 4 W., about 5 miles east of Kennett. The quality and extent is not known, as the deposit is considerably broken up on the surface and has not been developed.

Bibl.: Report VI, p. 98; Bull. No. 38, p. 107.

MINERAL SPRINGS.

Big Bend Hot Springs are located about 52 miles northeast of Redding, on land owned by J. E. Hill; post office, Big Bend. There are six mineral springs on this land, sulphur and iron, temperature 140° F. Good for rheumatism. No water bottled.

Bibl.: Report XI, p. 29.

Castle Rock is located in Sec. 15, T. 38 N., R. 4 W., about 2 miles north of Castella, at an elevation of 1900 feet. Owner, G. M. Parkinson. There are five mineral springs, waters contain sodium chloride, sodium carbonate, potassium, and a trace of lithium. Good for all stomach troubles. Daily flow 2000 gallons. Temperature 40°. Waters sold on the market.

Bibl.: Report XII, p. 346; Anderson, "Mineral Springs and Health Resorts of California," p. 119.

SANDSTONE.

A few miles northeast of Redding the Cretaceous Chico sandstone forms the surface rocks of Secs. 7 and 18, T. 32 N., R. 4 W. This deposit occurs in thick horizontal beds so that the quarrying of large blocks is a simple matter. Rock has a tawny color, quality is fair.

Bibl.: Bull. No. 38, p. 138.

At the *Texas Spring Quarry,* in Sec. 29, T. 31 N., R. 5 W., owned by California Sandstone and Construction Company of San Francisco, a little work has been done in the past, but the quality is not good on account of the number of niggerheads and fossils contained in the sandstone.

Bibl.: Bull. No. 38, pp. 138–139.

TUFF.

A belt of tuff extends from Clover Creek to Bear Creek, a distance of 5 miles, in Sec. 18, T. 31 N., R. 2 W.; in the forks of old Cow Creek, and South Cow Creek, a bluff of Tuscan tuff rises with steep sides from 30 to 50 feet high. The tuff has a light gray color and easily cuts to any desired form, but hardens on exposure. Being light, it makes a good building material for a temperate climate.

Bibl.: Bull. No. 38, p. 161.

ZINC.

A body of ore carrying zincblende and galena is found in Sec. 21, T. 34 N., R. 1 W. This ledge is 4 feet wide, strike east and west, dip 50° N. Slightly developed by means of a short tunnel. Country rock is shale.

Bibl.: Bull No. 38, pp. 355-356.

The ore of the *Donkey Mine* (Sec. 11, T. 33 N., R. 2 W.) carries considerable zinc, associated with copper, gold, silver and lead. This mine is listed under copper.

There is more or less *zinc* in the form of sphalerite associated with the ores of several of the copper mines of Shasta County, particularly at Bully Hill and at the Afterthought mine.

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1905	115, 164, 165–169, 172, 173, 181, 182.
1906	120, 178–185, 194, 195.
1907 (Part I)	120, 189–194, 198, 199, 221–225.
1908 (Part I)	168, 194, 205, 206, 316, 318, 320, 321, 324–326, 347–349.
1909 (Part I)	132, 167, 168, 261–266, 268, 269, 282–285.
1910 (Part I)	349, 350–354, 357–359, 375, 378.
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SISKIYOU COUNTY.

Field Work in September, 1913.

INTRODUCTION.

Siskiyou County, with an area of 3040 square miles, lies along the northern boundary of California, and has Del Norte adjoining it on the west, Modoc on the east and Shasta and Trinity counties on the south. It has an exceedingly broken and picturesque expanse of mountains, and canyons cut by many streams running westerly to the Klamath River and southward to the Sacramento River, the former stream coursing through the county for 70 miles.

The most prominent mountain ranges are the Klamath, Scott and Salmon. Mount Shasta, in the southern part, having an elevation of 14,380 feet, is a noted landmark. The Sierra Nevada lava sheet covers a portion of the eastern part of the county, forbidding both mining and agriculture.

The mineral wealth, which constitutes the basis of Siskiyou's prosperity, is concentrated in various belts and districts. There are two main agricultural sections, the Scott and Shasta valleys, which afford supplies for the surrounding country.

Although the day of simple placer mining has passed, the auriferous gravels still provide the bulk of the county's gold output. Gold dredging is being successfully pursued on McAdams Creek, near Fort Jones; and as there are many acres of gravel that will yield handsome returns by this method of mining, dredging bids fair to become one of the important industries of the county.

Hydraulic mining has been extensively pursued along the Klamath River and important tributaries, and large areas of pay gravel still remain to be worked. The old method of river mining by means of wing-dams has practically passed out of existence.

Quartz mining, which really gives stability to the industry, has made wonderful strides in Siskiyou County during the past ten years, in spite of the lack of transportation facilities, especially railroads. The Oregon branch of the Southern Pacific Railroad, which crosses the county, connects at Montague with the Yreka railroad, thus affording a rail connection for Yreka, the county seat. Wagon roads to the remote mining districts are being constructed as rapidly as the funds of the county will permit.

The unusual strikes of "high grade" ore in the Salmon range, especially in the Homestake and Highland mines, has stimulated lode mining and given the county the publicity it deserves. The Black Bear, with a production record of over $2,500,000, is the most noted gold quartz producer in Siskiyou County. There are many prospects that should develop into producers with the expenditure of a moderate amount of money. The conditions for mining are ideal, due to the abundance of both water and timber, and the California-Oregon Power Company affords cheap electrical power to many of the mining sections.

The minerals found within the borders of this county are many and widely distributed, among which may be enumerated, gold, platinum, silver, lead, chrome, copper, and coal. There are several mineral springs also, the most famous being the Shasta, on the line of the Oregon branch of the Southern Pacific railroad.

GEOLOGICAL AND TOPOGRAPHICAL FEATURES.

The formation and metalliferous belts of Siskiyou County are not so clearly defined as in the middle counties of the State; the Coast and Sierra Nevada ranges are here merged into one. The strike of the stratification has been changed from west of north to north 20° east.

In the Klamath, Salmon and Scott ranges, the mountains are rough and sharply defined, and table lands are seldom seen, as sharp serrated ridges have replaced them, with deep gorges and precipitous canyons.

Though the mountains of the western half belong to the Coast Range system, their general geological character is that of the Sierras, as granites, diorites and metamorphic slates and limestones, similar to the latter mountain system, comprise their mass. Between these western mountain systems and the lava beds, which cover a large area, including much of the drainage area of the Shasta and Little Shasta rivers and Cottonwood Creek, is a section, the characteristic rock of which is a fossiliferous sandstone. In the Shasta and Willow Creek valleys coal seams are found, stratified with the sandstone; these seams of lignite (coal) of good quality, vary from a few inches to four feet in width and rest on a quartzite substratum, which formed the rim rock of the basin.

Following the quartzite in a westerly direction for about 1 mile, a belt of magnesian rocks containing iron is observed, which continues for some 2 miles, when the main gold-bearing belt of the region is encountered.

DESCRIPTION OF STREAMS.

Klamath River.

This river and its tributaries have been important agents in the distribution of placer gold throughout the country (see photo No. 1). Its source is in the mountain ranges of northern California and southern Oregon, drawing from the Upper and Lower Klamath, Goose and Rhett lakes, and flowing southwesterly into the Pacific Ocean at a point forming the western extremity of the dividing line between Del Norte and Humboldt counties. The length of the Klamath is some

362 miles, the average grade being 12 feet to the mile, 70 miles of which is in Siskiyou County.

Gold is found wherever the river has deposited gravel, whether it be in an old channel a thousand feet above the present stream, or in the river bottom. Below the mouth of Scott River it has cut its way through the northern end of the Coast Range practically at right angles to its trend, and runs through a narrow canyon from a few hundred to several thousand feet in depth, with banks as steep as the material will stand and which are covered with a dense growth of timber and brush. At Oak Bar, Happy Camp, Hamburg Bar, Orleans Bar and a few other points, the mountains recede far enough from the stream to admit of a few acres of level land being farmed; the rest of the country is too steep for cultivation.

Photo No. 1. Klamath River near Happy Camp.

Bibl.: Report VIII, pp. 582, 584, 585.

Scott River.

Scott River, one of the important tributaries of the Klamath, enters this stream in Sec. 6, T. 45 N., R. 10 W., M. D. M., at an elevation of 1650 feet above sea level. It has a length of 61 miles, an average course of 20° to the northwest, and is fed by a watershed area of 812 square miles, with 26 miles of tributaries. This stream flows through the mineral districts of Oro Fino, Quartz Valley, Callahan and Scott Bar. In the vicinity of Callahan, on the headwaters of this stream and especially on the South Fork, rich deposits of gravel are found which have been mined for many years. Below Callahan the river runs through a portion of Scott Valley, a rich and fertile plateau, which is successfully cultivated, and in which are situated the flourishing towns of Etan and Fort Jones. The lower end of the river, for about 4 miles above its mouth, runs through a canyon, and here gold is found in the benches on the hillsides and in bars in the river. Scott Bar, in the center of this district and 2 miles from the mouth of Scott River, is the village from which supplies are distributed to the adjacent territory.

Bibl.; Report VIII, pp. 593, 594, 605, 606.

McAdams Creek.

This stream, a branch of Moffat Creek, tributary to Scott River, rises in the Forest Mountain Range and flows in a southerly direction. The placer ground on this creek, from its source to its junction, a distance of some 10 miles, has been rich, but the valley expands and the soil deepens so rapidly that only shallow depths were worked. It is good dredging ground, however, and the lower end of the stream is being worked by this method of mining.

Bibl.: Report VIII, p. 618.

Yreka Creek.

Yreka Creek, some 10 miles in length, rises in the Forest Mountains, flows in a northerly direction and empties into the Shasta River in Sec. 1, T. 45 N., R. 7 W., M. D. M. It is fed by several tributaries and has been an important gold producer in the past. Near Hawkinsville, 2 miles northeast of Yreka, the county seat, the valley is over 1 mile wide, and there is still a large area of auriferous gravel unworked, due to overburden and difficulty of drainage. Hydraulic elevators have been employed, with but poor success. The scarcity of water has also been another serious handicap.

Bibl.: Report VIII, p. 618.

Indian Creek.

Indian Creek, a tributary to the Klamath River, rises in the lofty snow-clad peaks of the Siskiyou Mountain Range, near the boundary line between California and Oregon. It has a length of 16 miles, flows in a southeasterly direction, and its tributaries, east and west, embrace 14 miles; its watershed area covers 144 square miles. Placer deposits are found along the entire length of Indian Creek. Happy Camp, a village on the west bank of the Klamath River at the junction of the Klamath and Indian Creek, is the distributing point for the country generally between Hamburg and Orleans Bar.

Bibl.: Report VIII, p. 599.

Beaver Creek.

This stream, a tributary to the Klamath River, rises in the Siskiyou Mountain Range, near Mount Sterling. It has a length of 12 miles, a general southwesterly course and is fed by the north and south forks of Hungary Creek, Bumble Bee, West Fork of Beaver and other smaller creeks. Placer mining has been pursued along these creeks for the past forty years, and although worked in a crude way considerable gold has been produced. The formations consist of granite, serpentine, slate and porphyrite-schist, cut by gold-bearing quartz ledges and porphyry dikes, which have fed these watercourses for ages.

Bibl.: Report VIII, p. 591.

Humbug Creek.

This creek, a tributary to the Klamath River, rises in the Humbug Mountains and flows in a northeasterly direction. It has a length of some 10 miles and has been a noted producer of placer gold. Near its source the banks of this stream are steep, the water being confined in a well defined canyon, of heavy grade, but as it approaches the river it widens out, forming large bars, which have been extensively mined. One claim of less than 7 acres has been constantly worked for the last thirty-five years, the output to date exceeding $260,000. Other creeks in this section tributary to the Klamath and which have been noted placer producers are Little Humbug and Barkhouse. From the head of Little Humbug over $2,000,000 was extracted by ground sluicing, and there is still considerable virgin ground to be worked, especially near its mouth, but there is only sufficient water in this creek to allow a two or three months' run each year. Barkhouse, the next creek below Little Humbug, has also been a noted producer, but mining operations are limited on account of the scarcity of water.

Bibl.: Report VIII, p. 591.

Mineral Production of Siskiyou County from 1894 to 1913 (incl.) from Records of State Mining Bureau.

Substances	1894	1895	1896
Gold	$760,781 83	$950,006 43	$1,091,264 82
Platinum	600 00	----------	----------
Silver	----------	177 30	652 65
Mineral waters	----------	80,800 00	----------
Totals	$761,381 83	$1,030.983 73	$1,091,917 47

Substances	1897	1898	1899
Gold	$842,123 00	$768,804 00	$991,771 00
Silver	34 00	321 00	100 00
Totals	$842,157 00	$769,125 00	$991,871 00

Substances	1900	1901	1902
Gold	$951,397 00	$886,043 00	$906,989 00
Silver	13,986 00	6,408 00	233 00
Mineral water	45,000 00	175,000 00	187,500 00
Copper			23 00
Totals	$1,010,383 00	$1,067,451 00	$1,094,745 00

Substances	1903	1904	1905	1906
Gold	$613,576 00	$892,685 00	$803,035 00	
Silver	22 00	1,230 00	2,499 00	
Mineral water	50,000 00	50,000 00		
Platinum		21 00	93 00	
Sandstone			1,250 00	$1,500 00
Totals	$663,598 00	$943,936 00	$806,877 00	$1,500 00

Substances	1907	1908	1909
Copper	$39 00		
Gold	398,017 00	$504,156 00	$416,160 00
Lead	140 00	183 00	144 00
Lime	1,000 00	1,680 00	300 00
Limestone	300 00		2,200 00
Mineral water	36,250 00	80,000 00	10,000 00
Rubble	39,000 00		500 00
Sandstone	12,897 00	1,485 00	1,750 00
Silver	3,037 00	6,125 00	2,145 00
Pumice stone			500 00
Macadam			4,528 00
Unapportioned, 1900–1909, inclusive			1,202,742 00
Totals	$490,680 00	$593,629 00	$1,640,969 00

Substances	1910	1911	1912
Crushed rock	$9,475 00	$6,580 00	
Gems	14,745 00	1,000 00	$250 00
Gold	437,376 00	422,297 00	472,314 00
Lime	735 00	120 00	
Limestone	525 00	24 00	
Mineral water	60,000 00	120,000 00	120,000 00
Sandstone	2,000 00	455 00	250 00
Silver	2,322 00	2,561 00	2,980 00
Chrome			2,310 00
Stone industry			609 00
Totals	$527,178 00	$553,037 00	$598,713 00

Substances	1913
Coal	$1,500 00
Gems	250 00
Gold	*180,125 00
Mineral water	120,000 00
Pumice stone	2,000 00
Silver	*1,228 00
Stone industry	4,883 00
Total	$309,986 00

*Production from dredging operations included in Stanislaus total.

ELECTRICAL POWER PLANTS.

The California-Oregon Power Company serves the following towns in Siskiyou County with cheap electrical power: Yreka, Montague, Hornbrook, Dorris, Ager, Hawkinsville, Thrall, Croy, Fort Jones, Oro Fino, Greenview, Walker, Etna, Weed, Sisson, Dunsmuir, and Castella.

The power plants are located at Fall Creek (capacity 2500 k.w.), Shasta River (380 k.w.), Klamath Falls (1500 k.w.), Gold Roy (2500 k.w.), Prospect (4750 k.w.), a total of 11,630 k.w. In addition to the plants mentioned, another is being installed on the Klamath River, near Fall Creek, with a capacity of 4000 k.w. and the system will then have a total generating capacity of 15,630 kilowatts.

CHROME.

Considerable float of chromite is found near the top of the Forest Mountains, in Sec. 13, T. 44 N., R. 8 W., Southern Pacific Railroad Company, owner; and in Sec. 18, T. 44 N., R. 7 W., Wm. Ramus and Carl Hill, Yreka, owners. The country rock is serpentine; the chromite is found in relatively small pieces. No development work has been done. Float of chromite is reported in the vicinity of the Dewey mine, about 10 miles southwest of Gazelle.

Bibl.: Bull. No. 38, pp. 272, 363.

CLAY PRODUCTS.

T. T. Garvey, of Yreka, owns a large bank of reddish colored clay, containing some minute quartz pebbles, in Sec. 27, T. 45 N., R. 7 W., M. D. M. A good quality of brick has been manufactured and used in Yreka.

Bibl.: Bull. No. 38, p. 257.

T. Hamilton, of Fort Jones, formerly made bricks from the surface clay from a deposit in Sec. 2, T. 43 N., R. 9 W.

Bibl.: Bull. No. 38, p. 257.

T. A. Reynolds, of Fort Jones, had an old brick kiln, using surface clay, from a deposit in Sec. 11, T. 43 N., R. 9 W.

Bibl.: Bull. No. 38, p. 257.

Peter Smith, of Etna, owns a bank of clay in Sec. 21, T. 42 N., R. 9 W., M. D. M. This deposit consists of 4 feet of clay of good quality, from which bricks were burned and used in buildings in Etna.

Bibl.: Bull. No. 38, p. 257.

J. Walker, of Greenview, has a deposit of grayish colored clay of good quality, located in Sec. 32, T. 43 N., R. 9 W., M. D. M.; a good grade of bricks manufactured at one time.

Bibl.: Bull. No. 38, p. 258.

COAL.

The coal deposits north of Yreka, in the vicinity of Hornbrook and Ager, have furnished a small amount of coal for domestic use for several years. It is a good grade of lignite, burns freely and leaves no klinkers.

The Black Butte Mountain Deposits near Ager, and the Kosh Creek deposits near Glazier along Kosh Creek in T. 38 N., R. 1 E., have not been developed at all.

The Siskiyou Coal Manufacturing Company's holdings near Hornbrook have been exploited by several open cuts along the croppings. The vein is 5 feet wide, with 30 inches of good lignite. Coal has been reported near Oak Bar, but is inferior in quality to the other deposits.

Bibl.: Report XI, p. 449.

COPPER.

The copper mines and prospects, while of recent development, are worthy of careful consideration, and are widely scattered over the central and northern portions of the county. The formations in which these deposits occur are either peridotite or gabbro, or a metamorphic schist overlying these eruptives, and several of the mountain peaks show the reddish-brown color which peridotite assumes in weathering. In the Happy Camp district, which has been noted for its placer gold production, there are several prospects of merit; and one property, the Grey Eagle, has been developed into a copper mine of considerable magnitude, with a large tonnage of ore blocked out.

Bibl.: Bull. No. 50, pp. 120–141.

Blue Ledge, owned by Blue Ledge Mining Company, of New York, is located in Sec. 21, T. 48 N., R. 11 W., M. D. M., in the Elliott mining district in the Siskiyou Mountain range and near the boundary line between California and Oregon. Elevation at mine is 4000 feet. Hutton is the nearest post office. The mine is connected by wagon road with Joe Bar, an old placer camp. The ore occurs in a north and south vein, dip vertical, its outcrop being traceable for 3000 feet; walls are micaceous schist. Ore consists of pyrite, chalcopyrite and other sulphides and oxides of iron and copper, the average value being above 6% copper and $5 per ton in gold. Two main tunnels 250 feet apart are connected by winzes and stopes; both show ore and have intermediate drifts showing over 150 feet in a solid body 40 feet wide in places. The workings comprise over 3000 feet of development. A large tonnage of ore blocked out. It is reported that the company has planned the erection of a smelter on the Applegate River.

Bibl.: Bull. No. 50, p. 128.

Copper Queen, in Sec. 3, T. 46 N., R. 7 W., in the Cottonwood mining district, 10 miles northwest of Hornbrook. Owners, J. D. and R. Abbott, of Yreka; comprises 20 acres on Hunter Creek; small ledge in lime and diorite-schist, 110-foot tunnel. Idle.

Bibl.: Bull. No. 50, p. 123.

Davis, in Sec. 12, T. 14 N., R. 6 E., in the Happy Camp mining district, 13 miles southwest of Happy Camp. Owner, R. Davis. Ledge 20 to 30 feet wide in schist and limestone; short tunnels; ledge not found in place as yet; strong gossan cropping, carrying some gold value; bonded to J. D. Farish and eight men employed; F. H. Dakin, superintendent; claims on Clear Creek.

Grey Eagle (formerly known as the *Dewey*), in Sec. 4, T. 17 N., R. 7 E., in the Happy Camp mining district, 8 miles northwest of Happy Camp. Owner, Incorporated Company, of New York; J. D. Farish, manager; Fred H. Dakin, superintendent; comprises 240 acres, patented; on Indian Creek at an elevation of 2550 feet; a strong vein from 10 to 80 feet wide in schist with a northwest and southeast strike and a dip of 45° E.; ore shoot over 300 feet long, consisting of chalcopyrite and pyrite; eight tunnels from 50 to 600 feet in length, six being crosscuts and two on the ledge; and several hundred feet of drifts and raises; large tonnage blocked out; ore carries from 2½% to 18% copper and $1.50 per ton in gold; strong gossan croppings on the surface; five men employed; property located in 1892 and sold to present company in 1908.

Bibl.: Bull. No. 50, p. 132.

Hummer, in Sec. 18, T. 40 N., R. 7 W., in Callahan mining district; owned by Mischler & Rollins, of Callahan. Claims worked to a limited extent by shallow shafts and open cuts; formation is serpentine, though the ore deposits are connected with dikes of quartz-porphyry which have penetrated the serpentine; ore lies in irregular bodies, consisting of pyrrhotite and other sulphides, carrying copper; ore said to contain nickel. Idle.

Bibl.: Bull. No. 50, p. 123.

Little, in Sec. 12, T. 46 N., R. 12 W., in the Seiad mining district; 10 miles west of Hamburg Bar. Owners, Little & Straisch; comprises 60 acres, located in 1899; ledge 39 feet wide, with northwest and southeast strike and dip of 20° E.; in schist and limestone; 40-foot tunnel. Idle.

Monarch, in Sec. 7, T. 40 N., R. 7 W., Callahan mining district; owned by Monarch Copper Mining Company, of Callahan; 240 acres, patented; tunnels and shafts (shallow); sulphide ore. Idle.

Bibl.: Bull. No. 50, p. 124.

Phillips, in Sec. 6, T. 46 N., R. 12 W., in the Seiad mining district; 14 miles west of Hamburg Bar. Owner, S. Phillips; comprises 40 acres, located in 1900; ledge 30 to 100 feet wide, with northwest and southeast strike and dip 35° E.; in schist and limestone; 110-foot tunnel; strong gossan cropping traceable for 1500 feet; only do assessment work.

Polar Bear, in Sec. 12, T. 40 N., R. 8 W., in the Callahan mining district; owned by Welkes & Sons; comprises one claim; ore bodies 6 feet wide, consisting of chalcopyrite and pyrrhotite, in serpentine; 200 tons extracted, said to carry 17% copper. Idle.

Bibl.: Bull. No. 50, p. 124.

Preston Peak, at head of South Fork of Indian Creek, 1½ miles north of Preston Peak; owned by Preston Peak Copper Mining Company; ledge 20 to 30 feet wide, in diorite; ores are pyrite and chalcopyrite; 300-foot tunnel in ore; ore said to carry 12% copper with gold; one of the pioneer discoveries of the Siskiyou belt. Idle.

Bibl.: Bull. No. 50, p. 132.

Plutus, in Secs. 12 and 14, T. 40 N., R. 8 W., in Callahan mining district; owned by McCarter, of Callahan; comprises five claims; ore, (pyrrhotite with small percentage of copper); occurs in gabbro and serpentine. Idle.

Bibl.: Bull. No. 50, p. 123.

Rainbow, in Sec. 24, T. 40 N., R. 5 W., in the Mt. Eddy mining district, 4 miles southwest of Sisson; owned by Wood & Sheldon Lumber Company; comprises 300 acres; tunnels and open cuts; one tunnel 400 feet long; ledge is 6 feet wide, in serpentine; ore is massive sulphides; gossan croppings 100 to 600 feet wide are exposed for over a mile on a spur of Mt. Eddy, having a strike of 70° NW. and dip of 60°; company's railroad near property; property was first worked for gold, thirty years ago. Idle.

Bibl.: Bull. No. 50, p. 125.

Rothrop, in Secs. 5, 6, 7 and 8, T. 43 N., R. 8 W., 4 miles northeast of Fort Jones; owned by George Henderson; comprises 15 claims; developed by shafts and tunnels; ledge 6 feet wide in serpentine; some of the ore is reported to carry 20% copper. Idle.

Bibl.: Bull. No. 50, p. 125.

Shiner, in Sec. 7, T. 46 N., R. 12 W., in the Seiad mining district; 12 miles west of Hamburg Bar. Owner, C. Shiner. Comprises 40 acres, at an elevation of 2000 feet; located in 1899; ledge 30 to 100 feet wide, with northwest and southeast strike and dip of 30° E., in schist and limestone; 80-foot tunnel; strong gossan cropping; ore is chalcopyrite. Only do assessment work.

Tebbe, in Sec. 32, T. 4 N., R. 9 W., in the Oak Bar mining district; 4 miles north of Oak Bar. Owner, G. A. Tebbe. Comprises 40 acres; ledge 30 feet wide in schist and limestone; 120-foot tunnel in ore. Idle.

Welch, in Sec. 1, T. 46 N., R. 12 W., in the Seiad mining district; 14 miles west of Hamburg Bar. Owner, E. Welch. Comprises 40 acres, located in 1899; ledge 30 feet wide, with northwest and southeast course and dip of 40° E.; in schist and limestone; two tunnels, 30 and 60 feet long; strong gossan cropping. Only do assessment work.

Yellow Butte, in Sec. 25, T. 40 N., R. 5 W., 15 miles from Montague, on the north slope of Mount Shasta; owned by Yellow Butte Mining Company; L. D. Ball, superintendent; vein is 5 feet wide, in schist and granite; strike north and south; dip 60° W.; ore is massive sulphide; tunnels and shafts. Idle.

Bibl.: Bull. No. 50, p. 126.

GOLD.

The main gold-bearing belt of Siskiyou County consists of metamorphic slates, granites, diorites, and limestones, with occasionally intrusive masses of porphyry, trap and syenite. This belt is from 5 to 12 miles in width and about 60 miles long, widening and narrowing at places on its line of strike, which varies from N. 20° to 30° E. In some places it is veined and seamed with stringers of quartz; in others it is soft, carrying talc in excess, with irregular bunches of quartz, rich in gold, designated in hydraulic mining as "seam diggings" and being easily worked with a stream of water under a heavy pressure head. In other localities on the belt, where the formation has been fissured,

Vol 14 1913-14

or near the line of contact, quartz veins occur either singly or in groups, and as a rule are small, but rich in gold.

This belt is interrupted and broken at several points and is by no means prolific in auriferous quartz veins throughout its entire extent, nor do the same rocks prevail in all the quartz districts.

A striking feature of the occurrence of the auriferous veins is their relation to the culminating peaks of the mountain systems crossed by the belt, for they conform to the lines of foliation of the ranges, being especially noticeable in the Salmon Range, New River, Knownothing, Deadwood and Humbug districts. Quartz Valley and Oro Fino, on opposite sides of a minor isolated mountain, are the only exceptions to the rule indicated.

Salmon Mountain, composed of eruptive rocks, porphyries and granites, seems to have been a disturbing element, as auriferous rocks do not come to the surface for about 10 miles beyond. Reaching as far as the known southerly limit of this gold-bearing belt extends, and crossing it, a belt of argillaceous slate and porphyry, having a width of 2 miles, is encountered, and then a decided belt of serpentine from 3 to 6 miles in width is entered, traceable for several miles on its line of strike. A belt of micaceous schist is observed at Scott's Bar, and westerly from this point belts of granite, limestone, and syenite are alternately crossed, until another belt of auriferous slates is entered, which has been but slightly prospected.

DESCRIPTION OF MINING DISTRICTS.

Salmon River District.

This district, the largest in Siskiyou County, comprises its entire southwestern corner, and includes the drainage area of the Salmon River and its tributaries. Topographically, it is a tangle of mountain ridges separated by precipitous canyons and river gorges. A wagon road 43 miles in length connects Etna, in Scott Valley, with Forks of Salmon, a small town located at the junction of the North Fork of the Salmon River. All the fairly level land in the district consists of a few bars on the Salmon River and its branches, so that this section is practically dependent on supplies from the outside.

Its mining industry, which is much scattered, is diversified among the several branches of placer and quartz mining, the former being followed along the Salmon River and its two principal branches, and to a less extent in some of the smaller side canyons making up into the gold-bearing quartz belts; large deposits are still untouched on the main river and on the South Fork. It is in quartz mining, however, that the permanent value of the district is to be realized. The main gold-bearing rock belt of the county crosses through the middle of this section.

In the geological center of the district, in the vicinity of Sawyer's Bar, several noted gold producers have been developed. They lie at the heads of Black Bear, Eddy's and White's gulches, from 4 to 10 miles distant from Sawyer's Bar. Quartz ledges on Jackass Gulch on the north side of the North Fork are being prospected and some pay ore developed. The Black Bear, Klamath, Gold Ball, Fagundez, Uncle Sam and Gold Run are the noted mines in this location. There are a number of prospects, also, which may develop into producers. In the same district near Snowden the recent strikes of ''high grade'' ore have caused considerable excitement. The Homestake, Highland, Overton, Zarina and Advance are the best known quartz properties, while the Big Cliff and Hardscrabble comprise two of the many promising prospects.

As a rule the country is heavily timbered and brushy, precipitous, and the surface broken, so that the quartz veins rarely show in place at the surface.

Bibl.: Report XI, p. 423.

Quartz Valley.

This district, occupying the northwest corner of Scott Valley, has two distinct kinds of placer mines. At the southern end of the valley the pay gravel lies on a flat, nearly level bedrock, without defined channel rims, covered with 60 feet of soft pebbly gravel and alluvium. The gold is coarse and water-worn and the deposit has been worked by drifting. Its source is probably the gravels of an old buried river, traces of which are observable in Douglas Hill, and in benches on the west side of the valley north of where Shackelford Creek enters it. Other traces of this old channel are found on the western edge of Scott Valley as far south as Callahan. The main placer deposit lies on the eastern side, and appears to be the result of the direct erosion of the ferruginous limestones that compose the western slope of the mountain separating Quartz Valley from the main Scott Valley. These limestones are seamed with auriferous quartz veins for some 5 miles. On the eastern slope of this mountain only one ravine seems to have been eroded deep enough to get to the gold bearing rocks, but on the Quartz Valley side there are four such ravines. These places consist of angular fragments of country rock and quartz with sand and clay, in depth from 1 to 30 feet, covered with a deposit of clay and surfaced with alluvium. The shallow placers near the heads of the ravines were worked out by the early-day miners. The gold is generally fine, rough and angular; and at one point from 8 acres of ground, over $200,000 was extracted, by means of hydraulic elevators.

Bibl.: Report XI, p. 434.

Oro Fino.

A low range of hills separates Quartz Valley from Oro Fino. This district is 22 miles southwesterly from Scott Bar by the course of the river. The auriferous dirt is evidently derived from the erosion and decomposition of the mountain sides in the immediate vicinity, as but few pebbles or gravel that show the action of running water or wash are found intermixed. A small ravine tributary to Oro Fino Creek constitutes practically all the placer ground in this district, and mining operations have been confined to the use of hydraulic elevators. The average fineness of the gold in this district is 785. Hydraulic washings have yielded from 75 cents to 85 cents per cubic yard of gravel. The two principal placer mines are the Eastlick Brothers and the Wright & Fletcher. The quartz veins, while numerous, all carry more or less gold and are small, and the gold generally occurs in pockets, in the limestone. The Green Mountain Tiger and Johnson have been the main quartz producers in this section.

Bibl.: Report VIII, p. 607; XI, p. 437.

Scott Bar.

This district, containing both placer and quartz mines, is situated on Scott River just above its junction with the Klamath, and was the first locality to be mined in Siskiyou County; it has been a remarkably rich district, although it includes a very small area (see photo No. 2). The gold, generally found on the bedrock, occurs in the form of nuggets, and is smooth and water-worn.

Photo No. 2. Scott Bar.

There are several large quartz ledges on Quartz Hill, which is across the river from Scott Bar, and one ledge is said to have yielded the Quartz Hill Hydraulic and Quartz Mining Company considerable gold. The surface has been rich hydraulic ground.

Bibl.: Report VIII, p. 605; XI, p. 447.

Humbug Creek.

This district, on the northeastern slopes of Old Baldy, is exclusively a quartz mining region, and is situated in the headwater forks and canyons of Humbug Creek, about 16 miles northwest of Yreka. The first mining in the district was carried on in 1854, and since that time considerable gold has been produced, although the operations have been practically confined to surface workings, due to a theory that the pay ore did not go down. As a matter of fact, a more intelligent exploration of the ore bodies has disproved the conclusions of the pioneer miners, and the properties that have been worked to any depth at all have yielded good returns, the Spencer and Mountain Belle mines being examples. The ledges in the serpentine are small, averaging 1 foot in width, and upon reaching the water level carry the gold largely with the sulphurets. The adjacent slates and granites are full of ledges carrying low-grade gold ores. The sulphurets consist of pyrite, blende and galena.

Bibl.: Report XI, p. 444.

Cottonwood.

This district, containing both placer and quartz mines, is located on the north side of the Klamath River, some 20 miles northeast of Yreka, and to the west of Hornbrook, a station on the Oregon branch of the Southern Pacific Railroad. It was originally noted for its rich, shallow diggings in Cottonwood Creek and the ravines tributary to it from the west. The old blue lead channel, famous for its rich gravel, is here exposed by erosion of the sandstone capping and cut through by the Klamath River. The gravel is blue and strongly cemented and compacted, while the bank contains considerable pipe clay hardened almost to the consistency of stone and filled with angular rock fragments. The gold is coarse, occurring mostly on or close to the bedrock. Both the channel and the capping are considerably displaced, and dip on an angle of about 12° to the east. In 1887 the outlet of the channel was discovered on the Klamath River, although the blue gravel had been mined in one of the ravines tributary to the Cottonwood, several years previous to that time. Some of the gravel on the bedrock gave returns of $6 per cubic yard.

The quartz prospects have been only partially developed and there is but little mining activity in this district at the present time. The country rocks, slate and quartz-porphyry contain many quartz ledges which carry gold values sufficient to warrant careful investigation.

The *Hazel*, with a gold production record of over $500,000, is the only quartz property that has been worked to any extent.

Bibl.: Report XI, p. 448.

Callahan.

The placer mines in this district are confined to the old gravel channel and bars of the South Fork of Scott River. The channel and high bars of the main Scott River, below the junction of the South and East Forks at Callahan, was mined for a distance of 3 miles, and a large annual gold output obtained. The high bars have been worked out and abandoned for a number of years, and the gold in the river channel is at such a depth that it cannot be profitably mined. On the South Fork, a few claims in the gulches and high bars are worked whenever water is available. On Jackson Creek, one of the headwater streams of the South Fork, 7 miles above Callahan, hydraulic mining is pursued on a small scale. The Montezuma River claim, 1 mile southwest of Callahan, was the largest gold producer, having a record of $50,000 annually.

Bibl.: Report XI, p. 433.

Happy Camp.

This district, also known as Indian Creek, is situated at the confluence of Klamath River and Indian Creek, some 70 miles west of Yreka, and contains both placer and quartz mines. The shallow and more easily removed gravel deposits have been worked out, but the benches are still being hydraulicked for their gold content. There is a large expanse of mineral land yet to be developed. The shallow diggings yielded large returns and were worked over by the Chinese after being abandoned by the white miner. The Classic Hill, on Indian Creek, one of the famous hydraulic mines of this district, was worked for a number of years by Chinese. The formation consists of a soft talcose slate, intercalated with stringers of quartz, which in places concentrate and form a well defined quartz vein, rich in gold, the deposit being known as "seam diggings." The quartz prospects are worked in a very limited way. The Grey Eagle copper mine is the only developed property in the district.

GOLD MINES—QUARTZ.

Advance, in Sec. 17, T. 40 N., R. 10 W., in the Liberty mining district, 13½ miles southeast of Etna Mills, in the Klamath Reserve. Owners, Advance Mining Company, of Denver; president, H. E. Wood; watchman, C. Ritz. Comprises 100 acres, patented, on Cow Creek. Short ore shoots in dioritic schist and limestone; 400-foot tunnel, drifts and stopes. Equipment consists of 1500-foot tramway, dwellings, and 5-stamp mill, driven by waterpower (water from Russian Creek, through 2 miles of flume). Idle for several years. Ore low grade and free milling. Hardscrabble prospect to the south.

Bailey, in Sec. 35, T. 46 N., R. 9 W., in the Deadwood mining district, 7 miles northwest of Fort Jones, at an elevation of 5000 feet. Owner, L. Bailey. Comprises 80 acres on Indian Creek. Short ore-shoot, in diabase. Worked for pockets. Some rich ore on the surface. Small producer. Idle at present.

Bibl.: Report VIII, p. 624.

Baker, in Sec. 15, T. 44 N., R. 9 W., in the Deadwood mining district, 7½ miles north of Fort Jones, at an elevation of 5000 feet. Owner, George Baker. Comprises 60 acres on Indian Creek. Short ore-shoot in slate. Worked for pockets. 300-feet tunnel. Old 5-stamp mill, driven by waterpower. Small producer.

Bibl.: Report, VIII, p. 625.

Bender, in Sec. 18, T. 42 N., R. 11 W., in the Liberty mining district, 4 miles north of Etna Mills, in the Klamath Reserve. Owner, A. A. Chamberlain. Comprises 40 acres, at an elevation of 3300 feet. Short ore-shoot in limestone and diorite. 340-foot tunnel and 250 feet of drifts. One 3½-foot Huntington mill, in poor condition. Some rich specimens found near the surface. Idle at present.

Ben Neil, in Sec. 10, T. 44 N., R. 9 W., in the Deadwood mining district, 11 miles northwest of Fort Jones at an elevation of 7100 feet. Owner, B. Neil. Comprises 40 acres. Short ore shoot in diorite; 100-foot tunnel. Small pockets taken out. Idle.

Big Ledge, formerly known as the *Lewis,* in Sec. 8, T. 43 N., R. 9 W., in the Oro Fino mining distrcit, 6 miles northeast of Greenview. Owner, G. Lewis. Comprises 20 acres. Pockets in diabase. One ore-shoot is 100 feet long and 15 inches wide; 360-foot tunnel. Only do assessment work. Idle.

Bibl.: Report XII, p. 277; XIII, p. 388.

Black Bear, discovered in 1860, is the most noted and largest quartz producer in Siskiyou County. It is in Sec. 13, T. 39 N., R. 12 W., in the Liberty mining district; 9 miles south of Sawyer's Bar in the Klamath Reserve. Owners, Black Bear Consolidated Mining Company, of Rollin; John Daggett, president; leased to Rollin Mining Company of San Francisco; J. L. Dunscomb, president; W. A. Farish, Jr., superintendent. The ore bodies occur in lenticular shaped deposits, which pinch out at times on the footwall side. The holdings comprise 70 acres of patented ground, consisting of the Black Bear, South Black Bear and Yellow Jacket claims, with 10 acres for millsite; workings consist of tunnels and two shafts; altitude, 3600 feet; water supply from Black Bear and Auges Creek, through two flumes, each 1 mile long, and

1600 feet of pipe; length along lode, 4500 feet; length of ore shoot, 150 feet; width of ore shoot, 3 feet; footwall, slate; hanging-wall, slate; number veins, two.

Black Bear and east and west crossing at right angles; character of ore, free milling; strike, north and south; dip, 40° E.; greatest vertical depth below outcrop, 600 feet; length driven on vein, 1500 feet; workings, six tunnels from 100 to 700 feet long; old shaft 550 feet deep (six levels); new shaft on Black Bear claim is 475 feet deep (size 10′ x 4′), sunk at an angle of 45° (3 levels); 4000 feet of drifts from old shaft, all to the west, several crosscuts; raise 3′ x 5′ x 30′, in new shaft from third level (200 feet); old stopes all filled; source of power, water and electricity; mine equipment, hoist, cars, compressor plant, compressor pump, tools, shops, assay office, dwellings, and 100 h.p. electric plant with 2 miles of power line; reduction equipment, 16 stamp mill, electrically driven (stamps weigh 650 pounds); number men employed, top 7, mine 2, total 9; cost (per ton): development, $2.00, mining $1.50, treatment $0.80, general $0.60; production to date, $3,100,000.

White Bear prospect to the north. From 1872 to 1881 the Black Bear mine paid $1,000,000 in dividends; most of the work performed on Black Bear claim; good wagon road from Sawyer's Bar to the mine.

Bibl.: Report VIII, pp. 620, 621; X, p. 656; XIII, p. 389.

Black Hawk, in Sec. 31, T. 46 N., R. 7 W., in Virginia Bar mining district; 5 miles north of Gottville in Klamath Reserve. Owners, Ladd & Ogden. Comprises 40 acres; formation granite and schist; ore found in small pockets; 100 foot tunnel; only do assessment work.

Blind Lode, in Sec. 18, T. 43 N., R. 9 W., in the Oro Fino mining district; 5½ miles northeast of Greenview. Owner, H. J. Diggles; comprises 20 acres of patented land, located in 1876; 150-foot ore shoot, 6 inches wide in diabase; four tunnels, longest being 600 feet; some rich ore extracted; said to have produced $40,000. Idle.

Bibl.: Report, XII, p. 278; XIII, p. 390.

Blue Jay, in Sec. 11, T. 47 N., R. 8 W., in Virginia Bar mining district; 5½ miles north of Gottville in Klamath Reserve. Owners, Blue Jay Mining Company; president, Mrs. P. D. Bennell; secretary, P. Billings; home office, Cleveland, Ohio; comprise 160 acres of patented land, purchased from Southern Pacific Railroad Company; formation, schist and diorite; one vein 150 feet long and 5 feet wide; low grade; two tunnels, 250 and 400 feet long; 10-stamp mill built by Union Iron Works; 1000-pound stamps; two Johnson concentrators; water power and steam; 2½ mile ditch from North Fork of Empire Creek; small production. Idle since 1907.

Blue Lead, in Sec. 26, T. 42 N., R. 9 W., in the Liberty mining district, 5 miles southeast of Etna Mills in the Klamath Reserve. Owner, L. H. Cory; comprises 40 acres of patented land; short ore shoot in diabase; rich on the surface; 580-foot tunnel, old 80-foot shaft and drifts comprise several hundred feet of development work; old 4-stamp mill (650-pound stamp); said to have produced $40,000. Idle since 1908.

Bonanza, in Sec. 14, T. 46 N., R. 7 W., in Cottonwood mining district; 10 miles southwest of Hornbrook in Klamath Reserve. Owners, Klondike Mining and Milling Company; president, J. P. Kleprock; secretary, L. P. Kleprock; home office, Long Beach; discovered in 1883 by C. Dovey; formation hornblende schist and granodiorite; short ore shoot; pocket mine; 1600-foot tunnel; equipment, dwellings and 5-foot Huntington mill; locator took out $10,000 in a pocket. Idle.

Boyle, in Sec. 8, T. 45 N., R. 8 W., in the Humbug mining district; 14 miles west of Yreka in the Klamath Reserve. Owner, C. E. Bunker; 100 acres located in 1880; two parallel veins, strike N. 40° W., and dip 60° S.; ore shoot is 200 feet long and 2 feet wide; formation is slate; five tunnels from 40 to 900 feet in length; only do assessment work. Idle.

Bibl.: Report XII, p. 278; XIII, p. 390.

Brown Bear, formerly known as *Golden* and *Eveleth's,* in Sec. 2, T. 39 N., R. 11 W., in the Liberty mining district; 3 miles southeast of Sawyer's Bar in the Klamath Reserve. Owners, Swain and Cleaver; comprises 100 acres on White's Gulch at an elevation of 3100 feet; 160-foot ore shoot, 18 inches wide, with a course of N. 20° E. and dip of 25° E.; 480-foot tunnel, drifts and stope; 4-stamp mill, driven by water power, from White's Gulch through 1½ miles of ditch and ½ mile of flume. Idle at present; has been a producer.

Bibl.: Report XII, p. 283; XIII, p. 402.

California Consolidated, formerly known as the *Golden Ball mine,* in Secs. 16 and 17, T. 39 N., R. 11 W., in the Liberty mining district; 3½ miles southwest of Sawyer's Bar in the Klamath Reserve. It is owned by the California Consolidated Mining Company; W. H. Young, of Oakland, president; Geo. Ball, superintendent; comprises 384 acres, 17 being patented; has been a producer and some ore still in sight, but no system of mining was pursued, so that much useless work was performed; altitude, 3800 to 4700 feet; fissure vein; length of ore shoot 1000 feet; width 6 feet; free milling; strike N. 20° to 40° E., dip 10° to 40° SE.; footwall, slate (soft); hanging-wall, slate; greatest vertical depth below outcrop, 600 feet; length driven on vein, 1000 feet; two levels, one at 50 and other at 125 feet; drifts, 160 feet, from 50-foot level, and 80 feet from 125-foot level; another from Stevens tunnel is 140 feet northeast and another 250 feet southwest; two crosscuts, 120 feet long; two winzes, each 60 feet deep; seven raises; two stopes in Stevens tunnel, each being 40 feet by 40 feet; several open cuts; equipment, 25 h.p. compressor, small hoist, 150 h.p. electrical plant (on North Fork of Salmon River at Sawyer's Bar) with 3 miles of power line, 1500-foot tramway, dwellings, and 20-stamp mill driven by electricity. Idle. Production to date is $473,500; idle since 1910; only assessment work being done; property should be a dividend payer if properly managed; said to be a continuation of the Black Bear lode.

Bibl.: Report XII, p. 282; XIII, p. 402.

Cape Cod, in Secs. 18 and 19, T. 45 N., R. 7 W., in Greenhorn mining district; 6 miles west of Yreka, in the Klamath Forest Reserve. Owners, Le May & Bulis; consists of 115 acres (40 acres patented); located in 1885; formation, slate and porphyry; two parallel veins, shoot 300 feet long and 14 inches wide; 300-foot tunnel; produced $12,000. Idle.

Central, in Sec. 34, T. 48 N., R. 8 W., in Hungry Creek mining district, 16 miles northwest of Hornbrook. Owners, Coil and Haslett. Located in 1893, 20 acres. Short ore shoots; ledge 2 feet wide; two tunnels, one 400 feet long; formation, granite and schist; free milling. Idle.

Champion, in Sec. 32, T. 12 N., R. 6 E., 10½ miles from Orleans, in the Cottage Grove mining district in Klamath Reserve. Owners, J. A. Hunter et al.; 180 acres, located in 1899; two veins, in porphyry; still in ore in workings; equipment, dwellings and one stamp mill (800-pound stamp) driven by water power, and 2-ton cyanide plant; water from Ten Eyck Creek through 2000 feet of ditch; claims are on the east slope of Prospect Hill; owner claims to have 14,000 tons of $15 rock in sight; three men employed; adjoins Twan & Hannan prospect.

Cherry Hill, in Sec. 25, T. 45 N., R. 8 W., in the Greenhorn mining district; 6½ miles southwest of Yreka in Klamath Reserve. Owner, Incorporated Company; several tunnels, longest being 200 feet; formation is diorite and porphyry; old 3-stamp mill, driven by steam power; adjoins Mt. Vernon on the west; been idle for a number of years; small production record.

Columbia, in Sec. 16, T. 45 N., R. 9 W., in the Scott River mining district, 7 miles northeast of Scott Bar in the Klamath Reserve; elevation of 4700 feet. Owner, Scott River Mining Company, of Seattle; C. F. Lee, president; comprises 40 acres, on Old Baldy Mountain; located in 1882; short ore shoot in slate and diabase; workings consist of 700-foot tunnel and 120-foot shaft; ore is free milling near the surface, but base with depth; equipment consists of dwellings and 10-stamp mill driven by steam and water power; only do assessment work; said to have been a producer at one time.

Bibl.: Report XII, p. 280; XIII, p. 394.

Condensed, in Sec. 12, T. 38 N., R. 11 W., in the Liberty mining district; 15 miles southeast of Sawyer's Bar in the Klamath Reserve. Owner, W. H. Cady; comprises 60 acres at an elevation of 2400 feet; short ore shoot in granite; little high grade found on footwall side; 220-foot tunnel. Idle.

Connor, in Sec. 18, T. 43 N., R. 9 W., in the Oro Fino mining district; 5 miles northeast of Greenview. Owner, J. Connor; comprises 20 acres short ore shoot; pay in pockets; 500-foot tunnel; said to have produced $15,000. Idle.

Bibl.: Report XIII, p. 395.

Crawley, in Sec. 22, T. 40 N., R. 8 W., in the Callahan mining district, 1½ miles southwest of Callahan in the Klamath Reserve. Owner, C. A. Warden Estate; comprises 60 acres; short ore shoots; pay ore occurring in pockets; in hornblende schist; 600-foot tunnel and 500 feet of drifts, 30-foot stope; old 2-stamp mill, 650-pound stamps; said to have produced $60,000; only do assessment work.

Bibl.: Report XIII, p. 396.

Cub Bear and Blue Jeans, in Sec. 9, T. 40 N., R. 10 W., in the Liberty mining district, 12 miles southeast of Etna Mills in the Klamath Reserve. Owners, Siskiyou Syndicate, of Los Angeles; president, I. J. Luce; secretary, M. Marx; superintendent, C. Ritz; comprises 100 acres; elevation 5800 feet; veins, two in number, occur in hornblende schist and quartz-porphyry; three short tunnels and open cuts, and ore being removed from the latter at present; good prospect 80 tons milled, which gave returns of over $20 per ton; five men are employed on the Highland lode; discovered in 1898 by Chas. Cory.

Cummings, formerly known as the *McKeen,* in Sec. 36, T. 40 N. R. 9 W., in the Callahan mining district, 3½ miles southwest of Callahan in the Klamath Reserve; has been one of the best quartz producers in this district. It is owned by the Shasta Mining Company, o Callahan, with James McKeen as manager-superintendent, and comprises 200 acres, patented, on Wildcat Creek at an elevation of 420 feet; strike of the vein is N. 40° E., dip 40° SW.; ore shoots ar short, being 130 feet long and 3 feet wide, all in granite; mai tunnel is 800 feet long and, together with the drifts, crosscuts an stopes, comprise several thousand feet of work, but no depth has bee attained; old Kinkead mill (driven by water power) and a dwelling, on the property; has been a good producer, said to exceed $500,000, and ore is free and easily worked; idle at present; has been worked since 1874.

Bibl.: Report XII, p. 280; XIII, p. 396.

Dewey, one of the noted quartz mines of Siskiyou County, is located in Sec. 23, T. 42 N., R. 8 W., in the Gazelle mining district; 12 miles southwest of Gazelle in the Klamath Reserve. It is owned by the Squaw Mining Company and comprises 100 acres, patented, at an elevation of 6800 feet; the strike of the vein is N. 40° E., dip 30° SE. The ore occurs in granodiorite, having a width of 3 feet; workings consist of a shaft 400 feet deep, a tunnel 920 feet in length, drifts, raises and stopes, all comprising several thousand feet of development work; equipment consists of hoist, dwellings, and old 10-stamp and Huntington mills (poor condition) operated by steam and water power; property said to have produced $900,000; discovered in the early eighties; idle since 1907.

Double Eagle and Little Quartz, in Sec. 26, T. 46 N., R. 9 W., in Oak Bar mining district in Klamath Reserve, 30 miles west of Hornbrook. Owner, H. H. Barton; comprises 20 acres; pocket mine; ore is hornblende schist and granitic-porphyry; 120-foot tunnel; produced $10,000, ore being crushed in an arrastra. Idle.

Bibl.: Report XIII, p. 397.

Eliza, in Secs. 4 and 9, T. 45 N., R. 8 W., in the Humbug mining district, 15 miles west of Yreka in the Klamath Reserve. Owners, Shur, Yunker & DeWitt, of Yreka. Group comprises 100 acres, located in 1865 by D. M. Lash; relocated in 1892 by present owners. Elevation is 4500 feet. There is a good wagon road from the property to Yreka. The location covers the lode for a distance of 4500 feet. The fissure vein occurs in quartz-porphyry and diabase, the former being the footwall and the latter the hanging-wall. The strike is N. 20° E. and dip 45° E.; ore shoot is 200 feet long and 5 feet wide; a 1400-foot tunnel has been driven on the vein, giving 360 feet of backs; above this lower tunnel there are four others from 100 to 800 feet in length; there are five stopes in all; equipment consists of dwellings and 10-stamp mill. Owners claim an ore reserve of 40,000 tons of value of $5 per ton and a production to date of $150,000; two men are employed doing development work in the lower tunnel; ore free near surface, but somewhat base with depth.

Elk Creek, in Sec. 3, T. 45 N., R. 7 W., in Hawkinsville mining district, 6 miles north of Yreka. Owners, Elk Creek Mining Company; president, L. F. Colburn; secretary, J. E. Harmon; home office, Yreka;

100 acres located in 1903, in Klamath Reserve; three parallel veins; 100-foot ore shoot 14 inches wide; formation, slate and porphyry; two tunnels 600 and 450 feet long; 10-stamp mill driven by electricity; production $20,000. Idle.

Fagundez (see *Humpback*).

Fleetwood and Nannie S., formerly known as *Old Jackson*, in Sec. 5, T. 45 N., R. 8 W., in the Humbug mining district, 16 miles west of Yreka. Owner, L. W. Cousins; comprises 80 acres; short ore shoots in granitic-porphyry; seven tunnels from 5 to 800 feet in length. Idle; only do assessment work.

Franklin, in Sec. 16, T. 44 N., R. 9 W., in the Deadwood mining district, 8 miles north of Fort Jones at an elevation of 5500 feet. Owners, Miller & Arnold; comprises 40 acres on Indian Creek; ore shoot is 120 feet long and 22 inches wide, with slate footwall and quartz-porphyry hanging-wall; 600-foot tunnel, drifts and 60-foot stope; claim production of $90,000; ore runs about $25 per ton and is worked in Baker's mill; leased to Wells & Brown. Idle since July, 1913; 20 tons of $25 rock on the dump.

Golden Eagle, formerly known as the *Sheba*, in Sec. 7, T. 44 N., R. 9 W., in the Deadwood mining district; 10 miles north of Fort Jones; was one of the producers in this section. It is owned by the Indian Creek Mining Company of San Francisco; president, I. J. Coe, and superintendent, T. E. Morrison; comprises 80 acres, patented; ore shoots are 200 feet long and 15 inches wide, with diabase footwall and quartz-porphyry hanging-wall; 750-foot tunnel, drifts and stopes, making several thousand feet of development work; the equipment, consisting of 50 h.p. boiler and 5-stamp mill, have been removed from the property and company has closed down and practically abandoned the buildings; has paid some dividends.

Bibl.: Report VIII, p. 625.

Golden Seal, in Sec. 18, T. 43 N., R. 9 W., in the Oro Fino mining district, 5 miles northeast of Greenview at an elevation of 3200 feet. Owner, V. Pitz; comprises 20 acres, located in 1885; 300-foot ore shoot 8 inches wide, in syenite and quartz-porphyry; 525-foot tunnel on the vein; a few pockets of high grade taken out. Owner works the claim in the winter.

Golden West, formerly known as the *King*, in Sec. 15, T. 39 N., R. 10 W., in the Salmon River mining district, 13 miles west of Callahan, in the Klamath Reserve. Owner, J. S. Baggs; comprises 60 acres on Trail Creek at an elevation of 7000 feet; fissure vein, in schist; 200-foot tunnel, still in ore; one man is employed; good prospect, with well-defined ledge of free milling ore, 4 feet wide and running from $8 to $15 per ton; discovered in 1904.

Gold Hill, formerly known as the *Gilta,* in Sec. 12, T. 9 N., R. 7 E., in the Liberty mining district, in Klamath Reserve, at an elevation of 3500 feet. Owner, E. A. Dannenbrink; comprises 60 acres of patented land; ore shoot is 250 feet long and 3 feet wide, in slate and diorite; several thousand feet development work, consisting of tunnels, crosscuts and stopes; equipment consists of dwellings, and 10-stamp mill operated by steam and water power, idle at present; twelve men employed, doing prospect work; property has been a producer.

Grizzly Gulch, in Sec. 14, T. 44 N., R. 9 W., in the Deadwood mining district, 10 miles north of Fort Jones at an elevation of 7000 feet. Owner, J. Shelly; comprises 60 acres; short ore shoots in diabase; worked for pockets; said to have produced $4000 from 80-foot tunnel. Idle.

Gumboat, in Sec. 15, T. 45 N., R. 9 W., 8 miles east of Scott Bar, in the Scott River mining district in the Klamath Reserve. Owner, A. Simon; comprises 40 acres; ore is base with depth (some chalcopyrite), occurring in slate; length of ore shoot not determined; 120-foot tunnel; 60-foot shaft; only do assessment work.

Bibl.: Report XIII, p. 404.

Hansen, formerly known as *Knownothing Creek,* in Secs. 1 and 12, T. 9 N., R. 7 E., in the Liberty mining district, 8½ miles southwest of Forks of Salmon, in Klamath Reserve. Owners, Roberts & Hagland; comprises 60 acres of patented land, located in 1880; short ore shoot, in slate and quartz-porphyry; several tunnels, longest being 850 feet, equipment, dwelling and old arrastra; two men employed doing prospect work; has been a small producer.

Bibl.: Report VIII, p. 622.

Hardscrabble, in Sec. 17, T. 40 N., R. 10 W., in the Liberty mining district, 14 miles southeast of Etna Mills in the Klamath Reserve. Owner, Hardscrabble Mining Company, of Los Angeles; C. B. Parrott, president; John Nefroney, superintendent; comprises 140 acres, at an elevation of 6100 feet; length of ore shoot not determined; country rock in dioritic-schist; 400-foot tunnel; two men employed. Highland Mine to the northeast.

Hazel, in Sec. 25, T. 47 N., R. 8 W., in the Cottonwood mining district, 4 miles southwest of Hornbrook, is the only large producer in this district. It is owned by the Hazel Gold Mining Company, of Chico; J. A. Jillson, president, and J. W. Roper, secretary. The group comprises 80 acres of patented land in the Klamath National Forest Reserve at an elevation of 2800 feet. There are three veins, known as the Potato Patch, "C" and Hazilett, which occur in the slate, the last two being practically parallel. The ore shoot is 150 feet long and 3 feet in width, with a 40° dip to the south. There are five tunnels from 100 to 1500 feet in length, all in the vein, comprising, with the drifts and stopes, several thousand feet of development work. The equipment consists of dwellings, assay office, and a 10-stamp Hendy mill (850-pound stamps) driven by waterpower from Ditch Creek through 1 mile of ditch. The property is said to have produced $800,000, but is idle at the present time. It was discovered in 1883 by H. Hazilett and then sold to the present owners.

Hicks, formerly known as *China Gulch.* In Sec. 2, T. 46 N., R. 7 W., 7 miles northwest of Hornbrook in the Klamath Reserve. Owner, J. T. Hicks. Comprises 40 acres. Ore shoot said to be 600 feet long, but only 3 inches wide on the surface, occurring in granite. Surface stripped of overburden and ore exposed a few feet below, which was crushed in an arrastra; 150-foot tunnel; 8-foot arrastra, run by water power; tailings impounded (150 tons on hand), which are to be treated in cyanide plant soon; said to assay from $5 to $15 per ton. Idle at present. Small producer.

Highland, in Sec. 16, T. 40 N., R. 10 W., in the Liberty mining district, 11 miles southeast of Etna Mills in the Klamath Reserve, is one of the noted quartz mines of this county. It is owned by the Belgium-Bohemian Mining Company, of Belgium. H. E. Mattern, superintendent. Comprises 100 acres at an elevation of 6400 feet. Supplies are brought over a 3-mile trail by means of pack animals; ore shoots are about 130 feet long and 2 feet wide, having a strike of N. 40° E and a dip of 30° SE.; footwall is dioritic-schist and hanging-wall is quartz-porphyry; workings consist of tunnels, the main tunnel having a length of 600 feet; there are several thousand feet of development work, all near the apex of the mountain, so that only a shallow depth has been obtained; equipment consists of cars, mining tools, assay office, dwellings, and a 10-stamp mill (modern pattern) run by gasoline; twenty-six men are employed; said to have produced over $350,000; best ore found in pockets; discovered in 1899 by P. Musick, who extracted $80,000 from pockets.

Highland, known also as the *Old Highland.* In Sec. 12, T. 39 N., R. 10 W., in the Salmon River mining district, 12½ miles northwest of Callahan in the Klamath Reserve. Owners, Denny-Bar Company. Comprises 60 acres on Trail Creek; fissure vein between walls of granite and schist, being an extension of the Trail Creek ledge; 200-foot tunnel, and 400 feet of drifts; ore is free and easily worked; idle at present; owners only do assessment work; Trail Creek prospect to the south.

Bibl.: Report XIII, p. 405.

Highland, in Sec. 25, T. 46 N., R. 7 W., in the Cottonwood mining district, 3 miles west of Hornbrook in the Klamath Reserve. Owner,

C. A. Myers. Comprises 60 acres; ore shoot is 125 feet long and 10 inches wide, being free milling and high grade; formation is slate; 1500-foot tunnel on the vein; idle at present; discovered in 1903 by Donnelly Bros.; then abandoned and relocated by Rogers, who abandoned it, and was relocated by present owner; small producer.

Hoboken, in Sec. 21, T. 45 N., R. 8 W., in the Deadwood mining district, 11 miles north of Fort Jones. Owner, T. A. Walker. Comprises 40 acres, patented, on Cherry Creek; 120-foot ore shoot, 10 inches wide, with diabase foot and slate hanging-walls; 600-foot tunnel and 250-foot drift; small producer at one time, the ore being crushed in an arrastra; idle since 1907.

Bibl.: Report XII, p. 284; XIII, p. 406.

Homestake, in Sec. 15, T. 40 N., R. 10 W., in the Klamath Reserve. Owners, Taylor & Bobs; J. F. Boyle, superintendent. Comprises 120 acres on the same lode as the Highland mine; formation is quartz-porphyry and dioritic schist; worked by means of tunnels; high grade (pocket) gold extracted, which has made the property noted; discovered in 1902; elevation is 6100 feet; eight men are employed; has produced several thousand dollars in high grade; 2-mile trail from wagon road.

Humpback, formerly known as *Fagundez,* in Secs. 4, 5, 8 and 9, T. 39 N., R. 11 W., in the Liberty mining district; 3 miles south of Sawyer's Bar in the Klamath Reserve. Comprises 80 acres of patented land on Eddy's Gulch; elevation 3400 feet; length along lode 6000 feet; ore shoot is 80 to 100 feet long and 1 foot wide; strike N. 20° E., dip 25° NE.; formation is slate; workings consist of 250-foot tunnel, drifts and crosscuts; small producer; idle for several years.

Bibl.: Report VIII, p. 619.

Inyo, in Sec. 2, T. 45 N., R. 8 W., in the Humbug mining district, 11 miles west of Yreka in Klamath Reserve at an elevation of 3100 feet. Owner, J. D. Fairchild. Comprises 20 acres, discovered in 1909; short ore shoots in quartz-porphyry pocket mine; produced $4000. Idle. Only do assessment work.

Ironsides, formerly known as *Little Wonder,* in Sec. 26, T. 45 N., R. 8 W., in Greenhorn mining district, 7 miles southwest of Yreka, in Klamath Reserve. Owner, James Ironsides; worked as a pocket mine; three short tunnels; small producer of high grade ore.

Bibl.: Report XII, p. 285; XIII, p. 408.

Johnson and China Paul, in Sec. 12, T. 43 N., R. 10 W., in Quartz Valley mining district, 7 miles north of Greenview. Owner, S. H. Holgate. Comprises 80 acres; 200-foot ore shoot, 10 inches wide, in diabase;

680-foot tunnel; some rich pockets extracted from Johnson claim; idle since 1910.

Bibl.: Report VIII, p. 626.

Kangaroo, in Sec. 29, T. 40 N., R. 7 W., in the Callahan mining district, 9 miles southeast of Callahan in the Klamath Reserve. Owner, C. O. Johnson. Comprises 60 acres; short ore shoot, in diorite and granitic-porphyry, 220-foot tunnel and 400 feet of drifts; worked for pockets; some high grade ore extracted.

Katie May, in Sec. 24, T. 45 N., R. 8 W., in the Greenhorn mining district, 6 miles west of Yreka in Klamath Reserve. Owner, A. S. Calkins; comprises 20 acres; located in 1886; relocated in 1900; short ore shoots in diorite and slate; 250-foot tunnel and 80-foot shaft; one stope, 60 feet by 4 feet by 50 feet; ore in sight consists of 100 tons, valued at $14 per ton; only do assessment work.

Bibl.: Report XIII, p. 409.

King Solomon, in Secs. 6 and 7, T. 38 N., R. 11 W., in the Liberty mining district, 12 miles southeast of Sawyer's Bar in the Klamath Reserve, is another of the quartz producers of Siskiyou County. It is owned by C. B. Cottrell, of Westerly, R. I.; W. H. Young, superintendent, and comprises 40 acres located in the eighties by P. Dannenbrink; length along lode 3000 feet; length of ore shoot, 230 feet; width 5 feet; strike north and south; dip 60° E.; footwall, quartz-porphyry; hanging-wall slate; ore free milling; workings: 130-foot shaft, tunnels, longest being 460 feet, over 1000 feet of drifts, cross-cuts and stopes, making in all several hundred feet of development work; equipment; cars, 30 h.p. boiler, small hoist, dwellings and an 8-stamp mill; has been a good producer and pay ore in sight; five men employed at present; mine being opened up so as to have a considerable tonnage blocked out.

Little Bonsa, in Sec. 9, T. 45 N., R. 7 W., in Hawkinsville mining district, 4½ miles north of Yreka. Owner, C. N. Gordon; in Klamath Reserve; 20 acres, located in 1910; short ore shoot, 6 inches wide; two tunnels, longest 40 feet; idle since 1912.

Lucky Strike, in Sec. 33, T. 41 N., R. 10 W., in the Liberty mining district, 9 miles southeast of Etna Mills in the Klamath Reserve. Owners, Lucky Strike Mining Company, of Los Angeles; president, T. Eagerly; superintendent, W. F. Smith. Comprises 80 acres; short ore shoot in hornblende schist; 450-foot tunnel; some high grade ore found near the surface; two men employed.

Lucky Strike, in Sec. 28, T. 45 N., R. 7 W., in Greenhorn mining district, 1½ miles northwest of Yreka. Owner, F. M. Osgood; superintendent, J. M. Beale; 160 acres, located in 1865; formation, slate; doing development work; 1000 tons of ore in sight; four tunnels and one 80-foot shaft; nine men employed. Some ore treated in custom mill at Yreka.

Marrian & Goodale, in Sec. 15, T. 40 N., R. 10 W., in the Liberty mining district, 9½ miles southeast of Etna Mills in the Klamath Reserve. Owner, Incorporated Company, of San Francisco; James Hogan, manager; comprises 80 acres, located in 1903; short ore shoot, in hornblende schist; 480-foot tunnel; rich bunches of high grade found; 2-stamp mill driven by steam power; dwellings; has been a small producer; idle at present.

McClaughry Group, in Sec. 8, T. 45 N., R. 8 W., in the Humbug mining district, 14 miles northwest of Yreka in Klamath Reserve. Owner, C. Humphreys; comprises 80 acres; formation is dolomite; 160-foot ore shoot, 2 feet wide; free milling; 600-foot tunnel; ore reserve consists of 1500 tons, assaying $20 per ton. Idle.

Monarch, in Sec. 8, T. 39 N., R. 11 W., in the Liberty mining district. Owner, G. R. Godfrey; comprises 40 acres, on Eddy Creek, at an elevation of 3300 feet; pocket mine; 150-foot tunnel; pockets occur in slate; only do assessment work.

Morrison & Carlock, formerly known as the *Little Queen,* is located in the Quartz Valley mining district, in Sec. 13, T. 43 N., R. 10 W., 4 miles northwest of Greenview, and comprises 60 acres of patented land. It is owned by the Richman Company of Fort Jones and has a production record of $500,000. Idle since 1907 on account of lawsuits. Altitude, 2800 feet; course of vein, N. 20° E, dip 45° E.; vertical depth 400 feet (shaft, size 5′ x 7′); number of levels, eight; 1200-foot drift to the west on this level; walls, limestone and quartz-porphyry; length of ore shoot, 350 feet; width 16 inches; 1500-foot tunnel on vein; character of ore, brittle smoky quartz, free milling; mine equipment: 35 h.p. steam hoist, Gould water pump, cages, dwellings, assay office; reduction equipment: 10-stamp mill built by Union Iron Works, operated by electricity.

Mount Vernon, in Sec. 25, T. 45 N., R. 8 W., in the Greenhorn mining district; 6 miles southwest of Yreka in Klamath Reserve. Owner, Incorporated Eastern Company; ore shoots are 150 feet long and 2 feet wide, occurring in slate; strike N. 40° E.; dip 50° S.; three tunnels, longest being 1200 feet on the vein; equipment; dwellings, assay office and 10-stamp mill driven by electricity, power being obtained by California-Oregon Power Company; has been a producer; worked at times by leasers; idle at present.

Nigger Boy, in Sec. 2, T. 46 N., R. 7 W., in the Cottonwood mining district, 5 miles southwest of Hornbrook in the Klamath Reserve. Owner, W. H. Allison; comprises 60 acres, located in 1898; formation is slate and diorite; ore shoot is 180 feet long and 2 feet wide; two tunnels, 1000 and 80 feet long on vein; equipment: dwellings, mining tools, blacksmith shop, 2-stamp mill driven by steam and water power; 1½ mile ditch from Ash Creek; under bond to Commercial Copper and Gold Mining Company, of Tallant, Oregon; three men are employed; some production, and ore reserves, claimed.

Ohio Group, in Sec. 8, T. 46 N., R. 6 W., in Fool's Paradise mining district; 7 miles south of Hornbrook. Owner, W. Seeman; 60 acres, patented, located in 1903; formation, syenite and diorite; base ore; 300-foot oreshoot, 1 foot wide; 500-feet tunnel. Idle.

Old Indian, in Sec. 4, T. 9 N., R. 8 E., in Liberty mining district; 9 miles southwest of Forks of Salmon, in Klamath Reserve. Owner, A. Nally; comprises 40 acres, located in 1892; short ore shoot in serpentine; 200-foot tunnel; old 120-foot shaft (caved); worked as a pocket mine; only do assessment work.

Old Vet and Eclipse, in Secs. 10 and 11, T. 45 N., R. 8 W., in the Humbug mining district, 10 miles northwest of Yreka in Klamath Reserve at an elevation of 3900 feet. Owner, J. P. Horn; comprises 40 acres; two parallel veins in granite; three tunnels, longest being 100 feet; few tons of ore milled, gave returns of $14 on plates.

Bibl.: Report XIII, p. 418.

Oregonian Group, formerly known as the *Malloy,* in Secs. 15, 16, 21 and 22, T. 40 N., R. 11 W., in the Liberty mining district; 3 miles northeast of Sawyer's Bar in the Klamath Reserve. Owner, D. Malloy; comprises 60 acres, located in 1886; 160-foot ore shoot 5 feet wide, strike N. 30° E., dip 40° NE.; strong ledge in granite; 420-foot tunnel; only do assessment work.

Bibl.: Report XII, p. 289; XIII, p. 419.

Oro Grande, in Secs. 10 and 11, T. 45 N., R. 7 W., in the Humbug mining district, 12 miles northwest of Yreka in the Klamath Reserve. Owners, Trask & Corinson; comprises 100 acres, located in 1860 and relocated in 1892 by present owners; four parallel veins, having dolomite foot and porphyry hanging-walls; 300-foot ore shoot, 2 feet wide; 300-foot tunnel and 160-foot shaft; one stope 80 feet by 4 feet by 40 feet; 10-foot arrastra run by water from Humbug Creek; owners claim ore reserve of 1000 tons, value $16; produced to date $20,000; some of the ore pans $40 per ton; owners do all the work.

Bibl.: Report, XIII, p. 419.

Overton, in Sec. 16, T. 40 N., R. 10 W., in the Liberty mining district; 13 miles southeast of Etna Mills in the Klamath Reserve Owners, Overton Gold Mining Company; C. E. Overton, president;

L. E. Buckner, superintendent; comprises 80 acres; ore shoots are 100 feet long and 20 inches wide, in dioritic schist; 420-foot tunnel, drifts and stope; 120 tons of ore on the dump, which is carried on mules to the Advance mill, a distance of 2 miles (5 mules handle 1 ton each trip, or 8 tons per day); property is idle at present; small producer.

Pilot Knob, in Secs. 23, 24 and 26, T. 47 N., R. 7 W., in the Virginia Bar mining district, 3 miles north of Gottville in Klamath Reserve. Owners, Pilot Knob Mining Company; president, W. D. Wall; secretary and superintendent, T. K. Anderson; home office, Gottville; comprises 310 acres; formation, hornblende schist; three veins; length and width of ore body not determined; crosscut tunnel 340 feet long, not in ore as yet; several small tunnels in ore; ore is free milling and runs $20 per ton; equipment consists of assay office, several dwellings, 600 feet of aerial tramway; 5-stamp Risdon Iron Works mill (850-pound stamps) run by water power; two men employed; last ore milled gave returns of $18 per ton from 16 tons; located in 1882.

Prospect Hill, in Sec. 30, T. 12 N., R. 6 E., 11 miles from Orleans in the Cottage Grove mining district in Klamath Reserve. Owners, C. S. Little; several small tunnels in porphyry; free milling, 3-stamp mill; small production.

Providence, in Sec. 18, T. 43 N., R. 9 W., in the Oro Fino mining district, 5 miles northeast of Greenview. Owners, Kradel Brothers; comprises 40 acres; short ore shoot in diabase; worked for pockets; 650-foot tunnel; small producer. Idle; only do assessment work.

Bibl.: Report XIII, p. 421.

Quartz Hill, in Sec. 16, T. 45 N., R. 10 W., in the Scott River mining district, ⅛ mile south of Scott Bar on Scott River in Klamath Reserve. Owner, H. G. Noonan, of San Francisco; comprises 45 acres of patented land on Quartz Hill, located in 1862; ore occurs in slate, and has been worked both as a quartz and hydraulic mine, the surface having been worked as a placer deposit at one time; water is obtained from Mill Creek through two ditches, one 6 miles and the other 5 miles in length; the strike is northeast and southwest; the bedrock, so-called, consists of alternate beds of slate and quartzite, enclosed by two parallel dikes, 1800 feet apart. The whole mass is crushed by these dikes of quartzite; practically only the surface has been worked; yearly production is from $10,000 to $12,000; equipment consists of old 10-stamp mill, two giants, and 1500 feet of pipe; some rich pockets found in the quartz seams. Idle at present.

Bibl.: Report XII, p. 290; XIII, p. 421.

Red Hill, in Sec. 4, T. 45 N., R. 7 W., in the Hawkinsville mining district; 5 miles north of Yreka. Owner, J. Phillips; in Klamath

Reserve; 13-inch vein; free milling; 40 acres, located in 1903; three tunnels, one 304 feet long; formation quartz-porphyry; ore treated in custom mill at Yreka. Produced $6,000.

Reeder Group, in Sec. 8, T. 46 N., R. 7 W., in Fool's Paradise mining district; 6½ miles south of Hornbrook. Owner, B. C. Reeder; 120 acres, located in 1875; formation slate; three tunnels, longest 250 feet; rich pockets taken out on Bonanza claim, largest being $20,000; said to have produced $50,000 to date; owner works claims.

Robinson Gulch, in Sec. 18, T. 40 N., R. 10 W., in the Liberty mining district, 14 miles southeast of Etna Mills at an elevation of 5400 feet. Owners, Robinson Gulch Mining Company, of Etna Mills; C. M. Chase, president; A. A. Dyer, superintendent; comprises 80 acres, located in 1903; short ore shoot in hornblende schist; 100-foot tunnel; only do assessment work; small pocket discovered on the surface.

Rough & Frye, in Sec. 30, T. 12 N., R. 6 E., 11½ miles from Orleans, in the Cottage Grove mining district in Klamath Reserve. Owner, C. Frye; 40 acres located in 1913; 175-foot tunnel and open cuts on surface for 600 feet; vein is 11 feet wide; free milling; some ore runs $15 per ton; doing development work.

Ruby Basin, formerly known as the *Jumbo,* in Sec. 36, T. 40 N., R. 11 W., in the Liberty mining district; 4 miles east of Sawyer's Bar in the Klamath Reserve. Owner, I. Cullberg, Jr., of Arcata; comprises 100 acres on White's Gulch; 160-foot ore shoot; free milling, 3 feet wide, north and south strike and dip 40° E.; in slate; 800-foot tunnel, 500 feet of drifts and 60-foot stope; old 10-stamp mill, driven by water power; small producer at one time. Idle at present.

Saint Lawrence, in Sec. 12, T. 43 N., R. 10 W., in the Quartz Valley mining district, 6 miles north of Greenview. Owner, A. G. Myers; comprises 20 acres; pockets in the quartz-porphyry; 220-foot tunnel. Idle.

Skelton, in Sec. 26, T. 41 N., R. 9 W., in the Liberty mining district, 5 miles southeast of Etna Mills in the Klamath Reserve. Owner, D. Skelton; comprises 20 acres, located in 1893; 130-foot vein, 4 feet wide, but base in character and probably too low grade to pay to work, as it only carries $3 in gold per ton, 2% copper and a little silver. Idle at present.

Specimen, in Sec. 15, T. 40 N., R. 9 W., in the Callahan mining district, 5 miles west of Callahan in the Klamath Reserve. Owner, W. Ellis; comprises 60 acres, on Craig's Gulch; short ore shoot in hornblende schist; worked for pockets, and some rich specimens extracted; 150-foot tunnel. Idle at present.

Bibl.: Report XIII, p. 427.

Star, in Sec. 12, T. 43 N., R. 10 W., in the Quartz Valley mining district, 6 miles north of Greenview. Owner, F. Star; comprises 20 acres, located in 1882; pockets in the quartz porphyry; 700-foot tunnel. Idle.

Sterling, in Sec. 20, T. 42 N., R. 8 W., in the Deadwood mining district, 13 miles northwest of Fort Jones at an elevation of 7300 feet. Owner, W. Crocker; comprises 40 acres on east fork of Deadwood Creek; short ore shoot in slate and diabase; worked for pockets; some rich ore extracted; 620-foot tunnel; only do assessment work.

Bbl.: Report XIII, p. 428.

Sundown, in Sec. 19, T. 47 N., R. 7 W., in Virginia Bar mining district, 4 miles north of Gottville in Klamath Reserve. Owners, Denver Mining Company, C. A. Von, president; home office, Denver, Colorado; comprises 60 acres; formation, diorite and schist; ore shoot 100 to 120 feet long, 2 feet wide; two tunnels, 150 and 800 feet long; 5-stamp mill driven by water power; 1 mile ditch from Dutch Creek; small production. Idle.

Taft, in Sec. 30, T. 11 N., R. 8 E., in Liberty mining district, 9 miles northeast of Forks of Salmon by trail; in Klamath Reserve; at an elevation of 2800 feet. Owner, C. Taylor; comprises 40 acres, located in 1908; pocket gold in slate; 100-foot tunnel; small production. Idle.

Teddy-Avalon, in Sec. 18, T. 47 N., R. 7 W., in Virginia Bar mining district, 7 miles north of Gottville in Klamath Reserve. Owner, E. J. Durkee; comprises 40 acres; formation is granite; short ore shoot, 1 foot wide; 125-foot tunnel; little high grade taken out; free milling.

Trail Creek, in Sec. 12, T. 39 N., R. 10 W., in the Salmon River mining district, 12 miles west of Callahan in the Klamath Reserve. Owner, Trail Creek Mining Company, of Callahan; George A. Foster, president and superintendent; George Hart, secretary; comprises 100 acres on Trail Creek at an elevation of 7200 feet, reached by trail from Callahan. The fissure vein occurs between schist walls, with a strike of N. 40° W., and a dip of 60° N.; ore shoot is 300 feet long and 2 feet wide; workings consist of an 850-foot tunnel, several small drifts and a stope 200 feet in length; equipment consists of two 3½-foot Huntington mills (capacity is 20 tons in twenty-four hours, through 50-mesh screen) run by waterpower; tools, ore cars and dwellings; seven men are employed; owner claims an ore reserve of 3000 tons of rock; free milling; yearly production 1912 (seventy days' run) was $15,000; production to date $40,000; best prospect in the district.

Twan & Hannan, in Sec. 30, T. 12 N., R. 6 E., 11 miles from Orleans in the Cottage Grove mining district in Klamath Reserve.

Owners, Twan & Hannan; comprises 40 acres; 400-foot crosscut tunnel, in porphyry; only do assessment work; ledge 4 feet wide on the surface; some ore crushed and treated in cyanide mill at Champion.

Uncle Sam Consolidated, formerly known as the *Sheffield,* in Secs. 3 and 10, T. 39 N., R. 11 W., in the Liberty mining district, 7 miles south of Sawyer's Bar in the Klamath Forest Reserve. Owners, Sheffield Estate; comprises 60 acres between White and Eddy gulches, located in 1873. Length along the lode, 3000 feet; length of ore shoot, 110 feet, and width 2 feet; vertical depth below outcrop, 300 feet; strike N. 20° E., dip 25° NE.; footwall, slate; hanging wall, quartz-porphyry; length driven on vein, 420 feet; ore free milling; water supply from White's Gulch through 1½ miles of ditch and ½ mile of flume; old workings consisting of stopes and drifts are caved; equipment consists of dwellings and old 8-stamp mill, 780-pound stamps; producer for several years; some good ore in workings. Idle at present.

Bibl.: Report VIII, p. 619; XI, p. 433; XII, p. 293; XIII, p. 431.

Wicks, in Sec. 13, T. 44 N., R. 10 W., in the Deadwood mining district, 12 miles northwest of Fort Jones at an elevation of 6200 feet. Owner, Weeks Bros.; comprises 40 acres; short ore shoot in diabase, badly faulted; little high grade extracted on the surface; 150-foot tunnel. Idle.

White Bear, in Sec. 13, T. 39 N., R. 12 W., in the Liberty mining district, 9 miles southwest of Sawyer's Bar in the Klamath Reserve. Owners, Daggett & Smith; comprises 20 acres, north of the Black Bear, on an east and west vein; ore shoot is 100 feet long and 2 feet wide, with a dip of 30° E.; 400-foot tunnel and 2 drifts, each 80 feet in length; equipment: dwelling and 5-stamp mill; good prospect, but only small amount of development work; owners expect to employ several men during the winter. One man at work at present.

Zarina, in Sec. 33, T. 41 N., R. 10 W., in the Liberty mining district, 9½ miles southeast of Etna Mills in the Klamath Reserve. Owners, Zarina Mining Company, of Etna Mills; J. W. Harris, superintendent; comprises 100 acres, located in 1900; elevation, 6500 feet; ore shoot, 130 feet long and 2 feet wide; dioritic schist walls; 350 and 80-foot tunnels, drifts and stopes; equipment consists of dwellings and 5-stamp mill, driven by water power from lake above the property; small producer; not worked on any scale since 1911. One man employed at present; best ore found in pockets, similar to the Highland.

GOLD MINES—PLACER.

A succession of terraces or benches of considerable width covered with trees and shrubbery and containing auriferous gravel banks, which range from 50 to 200 feet in height, are frequent along the Klamath River and its tributaries. These benches are often miles in extent, being frequently cut by the more modern and deeper channels, and were probably formed by glacial action, causing the river to seek a new channel, for the rim rocks are intact and sharply defined and were not worn away gradually. These old gravel channels have played an important part in the mining production of this county.

An important change has taken place at the junction of the Scott River with Klamath, for here are found terraces or benches, usually three in number, with well defined trough-shaped depressions, rims intact, receding and ascending gradually from the river bed or its banks and forming a series of steps from 200 to 300 feet apart and from 50 to 200 feet between respective channels. These are evidently the old river courses, buried in places 100 feet deep under the rocky debris that had slid from the mountain side during a cataclysm of nature, causing new channels cutting deeper into the rocky formation, to be formed. These deposits have been worked by both drift and hydraulic mining.

Approximate production of placer mines, along the Klamath River from Humbug Creek to Scott River (from a known area):

Name of property	Size of ground worked			Number of cubic yards	Value taken out	Average per cubic yard
	Length in feet	Width in feet	Depth in feet			
Virginia Bar	100	50	10	1,851	$30,000	$16 20
M. Mott, at head of Virginia Bar	50	16	10	296	8,000	27 00
Centennial	685	40	40	40,000	97,000	2 42
Manzanita Bar	1,600	200	25	296,296	300,000	1 01
Yankee Dam	100	60	4	888	13,000	14 62
Vatinell & Co.	150	50	6	1,666	8,000	4 80
Pierson & Co. below Oak Bar	150	20	3	836	7,300	8 72
Poverty Point drift mine	1,500	30	6	10,000	23,000	2 36
Maplesden wing dam	150	30	30	5,000	30,000	6 00
Daggett	200	50	5	1,851	25,000	13 50
Kols wing dam	60	30	6	400	1,100	2 75

Portuguese Company, at Oak Bar, took out, with eleven men and use of derrick, in three days, by hand shoveling, $3000, or at rate of $1000 per day.

China Sam took out in one tub, or 5 cubic yards, 8 ounces of gold, valued at $134.

Wm. McConnell's claim, Humbug Creek, took out in one season, $34,000; same claim, next season, $28,000; same claim, next season, $22,000; total, $84,000; pick and shovel, and use of derrick, from one acre.

Daggett Mine, worked with pick and shovel, with four men, averaged $100 per day for several months.

From Pine Grove Mine, from a pit 100 feet square, on bedrock, and 18 feet deep, $6,000 was extracted.

GOLD MINES—HYDRAULIC.

Bark House Creek, in Secs. 23 and 26, in Oak Bar mining district, 26 miles west of Hornbrook in Klamath Reserve. Owners, N. E. and P. C. Lange; comprises 200 acres; micaceous schist bedrock; coarse gold found in crevices of bedrock; good producer years ago. Idle at present.

Beaudry, in Secs. 3, 11, 34, 35, 30, 26, 2 and 23, T. 39 and 40 N., R. 8 and 9 W., in the Callahan mining district, 1 mile southeast of Callahan in the Klamath Reserve is the best paying hydraulic mine in this district. Owner, J. Beaudry; comprises several of the old placer locations, with an area of 640 acres on Scott River and Wildcat Creek; the bedrock is schist; gravel 20 to 60 feet deep; water is obtained from South Fork of Scott River and Wildcat Creek through two ditches, one 15 and the other 2 miles in length; 7 giants, 4000 feet of pipe and three dwellings on the property; six men employed at present making repairs to ditches; use fifteen men during the season; production said to be from $25,000 to $40,000 per year.

Belle Josephine, formerly known as *Slide Creek,* in Sec. 14, T. 39 N., R. 9 W., in the Callahan mining district, 6 miles southwest of Callahan in the Klamath Reserve. Owner, A. E. Westover; comprises 160 acres, on Slide Creek, including the Abers, Carter and other old placer mines, which have been noted producers; schist bedrock; 30 to 50 feet of gravel; water from Slide Creek through a ditch 2 miles long, carrying 1100 inches; equipment consists of four giants, 2500 feet of pipe and two dwellings; twelve men employed during operating season, but only three men at present. Cost about $1500 per year for ditch repairs; property is paying dividends.

Bloomer, in Secs. 33 and 34, T. 11 N., R. 7 E., in the Liberty mining district, 6 miles northwest of Forks of Salmon in the Klamath Reserve. Owners, Bennett Company; comprises 51 acres of patented land; bedrock is schist; worked extensively years ago and was good producer. Idle.

Bibl.: Report VIII, p. 612; XII, p. 278; XIII, p. 390.

Blue Gravel, formerly known as the *Black Lead,* in Sec. 32, T. 45 N., R. 7 W., in the Greenhorn mining district, 2 miles south of Yreka in Klamath Reserve. Owners, Smith & Lee; comprises 200 acres, located in 1888; it was a famous placer producer at one time; slate bedrock;

10 feet of gravel; about 60 acres have been worked. Idle since 1910; has been drilled for dredging ground.

Bibl.: Report XIII, p. 390.

Blue Hill, in Sec. 16, T. 45 N., R. 10 W., in the Scott Bar mining district, ⅛ mile south of Scott Bar in the Klamath Reserve. Owner, E. Jacobs; comprises 20 acres, along Scott River; slate bedrock; 20 to 40 feet gravel; water from Mill Creek through a ditch ½ mile long; equipment one giant and 1000 feet of pipe; worked on a small scale. Idle on account of lack of water.

Bowersox, in Sec. 2, T. 11 N., R. 7 E., in the Liberty mining district at Somes Bar in Klamath Reserve. Owner, W. P. Bowersox; comprises 40 acres; schist bedrock; 20 feet of gravel. Idle; only worked to limited extent.

Brown & George, in Sec. 1, T. 38 N., R. 11 W., in the Liberty mining district, 14 miles southeast of Sawyer's Bar in the Klamath Reserve. Owners, Banner Mining Company; T. H. George, superintendent; comprises 40 acres on Shattuck Creek; schist bedrock; 10 to 40 feet of gravel; two giants and 1000 feet of pipe. Idle.

Bibl.: Report XIII, p. 391.

Campbell, in Secs. 1, 2, 11, 12, 13 and 14, T. 43 N., R. 10 W., in the Quartz Valley mining district, 6 miles north of Greenview. Owners, Weed & Gardner; holdings comprise 1500 acres of patented land, being practically all the placer ground in this district, and includes the old Hull Gulch, Sucker Flat, Smith & Hand, Van Duzen Gulch and Meads Gulch properties; bedrock is quartz-porphyry; gravel from 20 to 80 feet deep; water from Kidder and Shackleford creeks, through two ditches, one 14 and the other 5 miles long; equipment consists of three giants, and 3000 feet of pipe. Idle since 1910; some rich gravel; at one time a large production was obtained from these mines.

Bibl.: Report XII, p. 279; XIII, p. 392.

Cecilville, formerly known as the *Sightman,* in Sec. 30, T. 38 N., R. 11 W., in the Liberty mining district, 15 miles southeast of Sawyer's Bar in the Klamath Forest Reserve. Owner, G. H. Sightman; comprises 40 acres on Crawford Creek; schist bedrock; 20 to 60 feet of gravel; water from Crawford Creek through 2½-mile ditch; one giant and 800 feet of pipe; only worked on a limited scale during the winter; small producer.

China Creek, formerly known as the *Reeves,* in Sec. 5, T. 16 N., R. 7 E., in the Happy Camp mining district, 6 miles northeast of Happy Camp in the Klamath Forest Reserve. Owner, Chinese Company; comprises 40 acres of patented land; schist bedrock; 10 to 40 feet of gravel. Idle several years; good producer in the past.

Bibl.: Report XIII, p. 393.

Classic Hill, in Sec. 36, T. 18 N., R. 6 E., in the Happy Camp mining district, 12 miles north of Happy Camp in the Klamath Forest Reserve. Owner, C. Wheeler; comprises 43 acres of patented land; schist bedrock; 5 to 30 feet of gravel; water from west branch of Indian Creek through a ditch 5 miles long, carrying 600 inches; equipment consists of two giants and 1000 feet of pipe; has been a good producer. Idle.

Bibl.: Report XIII, p. 394.

Crapo, in Sec. 11, T. 10 N., R. 7 E., 3 miles southwest of Forks of Salmon in Klamath Forest Reserve. Owners, Bennett Company; comprises 39 acres of patented ground; slate bedrock; 20 feet of gravel. Idle.

Bibl.: Report VIII, p. 612; XII, pp. 280, 282; XIII, p. 396.

Cronin, in Sec. 22, T. 40 N., R. 12 W., in the Liberty mining district, 7 miles west of Sawyer's Bar in the Klamath Forest Reserve. Owner, French Syndicate of Paris, France; J. Sapp, watchman; comprises 40 acres, patented, on West Fork of Salmon River; slate bedrock; 30 to 100 feet of gravel; water from Boulder Gulch through 2-mile ditch carrying 800 inches; 5 giants, 3000 feet of pipe, derrick and dwellings; good producer at one time. Idle since 1910.

Bibl.: Report XIII, p. 396.

Davis, formerly known as the *Van Brunt*, in Sec. 11, T. 16 N., R. 7 E., in the Happy Camp mining district; $\frac{1}{8}$ mile southwest of Happy Camp, was located in 1870 and has been worked since that time. It is owned by R. A. Davis, of San Francisco, and comprises 200 acres of patented land along the Klamath River; the bedrock is schist and the gravel in places is more than 100 feet deep. Water is obtained from the South Fork of Indian Creek, through a ditch 10 miles long, having a capacity of 120 inches and which cost $40,000; equipment consists of three giants, sluice boxes and 2000 feet of pipe; twelve men employed during operating season; cost of operating about $10,000 (period of five months); pays dividends; small amount of platinum obtained. (See photo No. 3.)

Denny, in Secs. 17, 20, 21 and 29, T. 40 N., R. 8 W., in the Callahan mining district, in town of Callahan, in the Klamath Reserve. Owners, Scott River Dredge Company; comprises 400 acres of old locations along the Scott River, 118 acres of which is patented; schist bedrock; 20 to 60 feet of gravel, some boulders and some cement near the bedrock; 3-mile ditch from South Fork of Scott River; ground

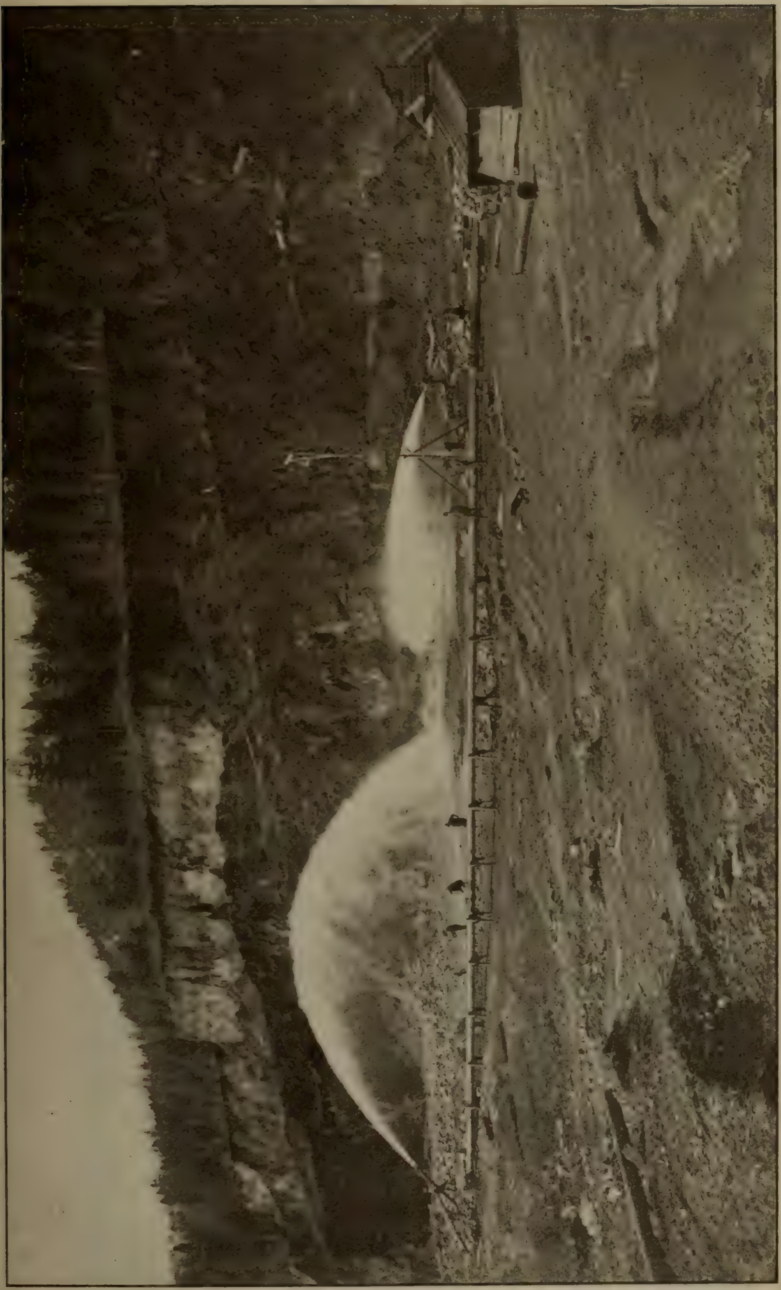

Photo No. 3. Davis hydraulic mine—Happy Camp.

noted placer producer in the early days; company endeavored to work the bed of Scott River with a small dredge, but did not understand this business and dismantled the boat in 1910 and sold the machinery; property idle since that time; some good ground yet to be worked.

Dick Morris, formerly known as the *Ramis,* in Sec. 35, T. 46 N., R. 11 W., in the Hamburg Bar mining district, 1¾ miles northwest of Hamburg Bar in the Klamath Reserve. Owners, Johnson & Hanses; comprises 40 acres; schist bedrock; 10 to 30 feet of gravel; two giants and 500 feet of pipe. Idle. Adjoins Hammer on the north.

Dunnigan, in Sec. 20, T. 12 N., R. 6 E., in the T-Bar mining district, 36 miles (by trail) south of Happy Camp in the Klamath Forest Reserve. Owners, Dunnigan Consolidated Mining Company, of San Francisco; E. M. Wilbur, president; Mrs. E. J. Wilbur, secretary; J. M. Stickel, general manager; holdings comprise 160 acres, consisting of old benches; portion of land worked in the early days and relocated by J. M. Stickel in 1912; water obtained from T-Bar Creek through ditch ¼ mile long; bedrock in serpentine and slate; depth of gravel from 10 to 40 feet (loose); equipment consists of two giants, 2000 feet of pipe, dwelling and sluice boxes; one man employed at present; company intends to work a full crew in the spring; said to be good ground.

Eastlick, in Secs. 17 and 18, T. 43 N., R. 9 W., in the Oro Fino mining district, 5 miles northeast of Greenview. Owners, Richman & Beems, of Fort Jones; comprises 67 acres of patented land; bedrock is quartz-porphyry; 30 to 60 feet of gravel; two ditches from Mill and Kidder creeks, one 6 miles and the other 4 miles long; equipment consists of three giants and 2600 feet of pipe; noted property at one time and yielded good returns. Idle for past three years.

Bibl.: Report VIII, p. 608; XII, p. 281; XIII, p. 398.

Elliott, formerly known as the *Golden Nugget,* in Sec. 20, T. 40 N., R. 11 W., in the Liberty mining district, ¾ mile north of Sawyer's Bar in the Klamath Forest Reserve. Owner, M. L. Elliott; comprises 20 acres, patented, on Jackass Gulch; slate bedrock; 15 to 40 feet of gravel; two giants, 1000 feet of pipe and derrick; water from Jackass Gulch through a flume 1½ miles long; good production in 1911; coarse gold on bedrock; worked in winter.

Bibl.: Report VIII, p. 603.

Ellston, in Sec. 33, T. 11 N., R. 7 E., in the Liberty mining district, 10 miles northwest of Forks of Salmon in Klamath Forest Reserve. Owner, A. E. Ellston; comprises 30 acres; slate bedrock; 20 feet of gravel. Idle; only does assessment work; some rich gravel worked years ago.

Espey, in Sec. 25, T. 47 N., R. 9 W., in the Oak Bar mining district, 30 miles northwest of Hornbrook. Owners, Espey Mining Company; home office, Seattle, Wash.; in Klamath Reserve; 50 acres of ground; bedrock is schist. Idle on account of lack of water.

Fir Tree, in Secs. 19 and 20, T. 10 N., R. 8 E., in the Liberty mining district, 1 mile southeast of Forks of Salmon in Klamath Forest Reserve. Owners, Bennett Company; comprises 20 acres of patented ground; schist bedrock; 10 feet of gravel; 2½-mile ditch from Salmon River. Idle; has not been worked for several years.

Forks, formerly known as *McNeals,* in Sec. 13, T. 10 N., R. 7 E., in the Liberty mining district, in town of Forks of Salmon in the Klamath Forest Reserve. Owners, Bennett Company; comprises 50 acres; schist bedrock; 20 feet of gravel. Idle; under option to the La Grange Mining Company; some rich gravel.

Bibl.: Report XII, p. 287; XIII, p. 401.

Forks of Salmon River, in Secs. 16, 17, 18, 13, 7, 8 and 9, T. 10 N., R. 7 and 8 E., in the Liberty mining district, 1½ miles northeast of Forks of Salmon in the Klamath Forest Reserve, is the largest hydraulic

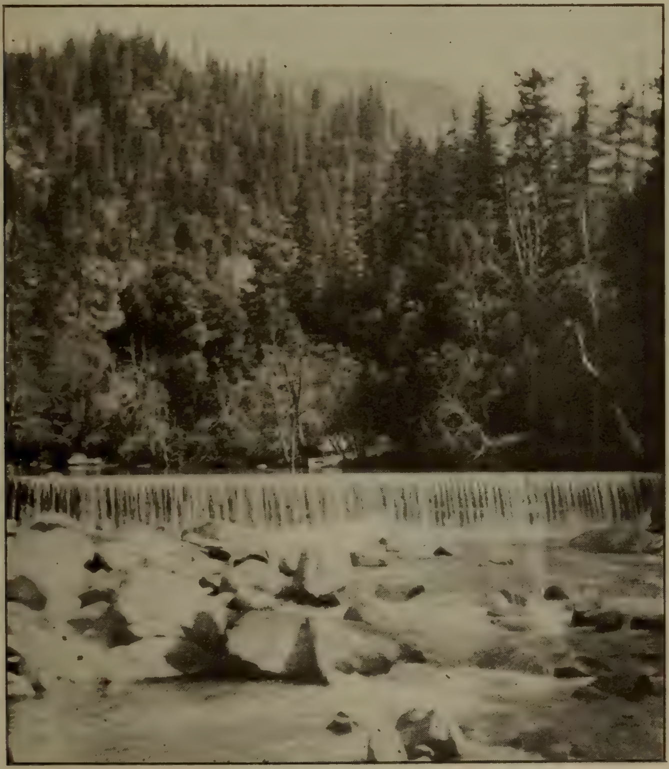

Photo No. 4—Dam—Forks of Salmon River Mining Company.

mine in this district. It is owned by the Forks of Salmon River Mining Company, of San Francisco; F. Salvage, president; V. G. Bonaly, secretary, and M. A. Singer, superintendent. The holdings comprise 520 acres of old placer locations, which were rich diggings in the early days. This company controls some 4 miles of the old channels and bars along the North Fork of Salmon River. The bedrock is schist, with 20 to 60 feet of gravel covering the same; only about 3 acres of ground have been worked. Water is obtained from the North Fork of the Salmon River through a ditch carrying 3800 inches, having a length of 4 miles and a 50-foot pressed overflow dam impounds the water at the intake. The equipment consists of five giants, machine shop, small electrical plant, pipe, derricks, and dwellings; sixteen men at $3 per day are employed. In 1911 and 1912, the yearly production exceeded $60,000; has produced over $200,000 since 1908.

Fort Goff, in Sec. 31, T. 47 N., R. 12 W., in the Seiad mining district, 14 miles west of Hamburg Bar in the Klamath Reserve. Owner, G. Martin; comprises 80 acres of patented land along the Klamath River; schist bedrock; 10 to 60 feet of loose gravel; water obtained from Fort Goff Creek through a ditch 1½ miles long carrying 800 inches; equipment consists of two giants and 3100 feet of pipe; has not been worked since 1911; some good ground; small producer.

Bibl.: Report VIII, p. 596; XII, p. 283; XIII, p. 401.

Gardner and Deming, in Secs. 7 and 18, T. 43 N., R. 9 W., in the Oro Fino mining district, 5½ miles northeast of Greenview. Owners, Weed & Gardner; comprises 150 acres of patented land; bedrock is quartz-porphyry with quartz stringers running through it; 10 to 50 feet of gravel. Idle.

Bibl.; Report XIII, p. 402.

Geeshan and Kellner, in Sec. 30, T. 40 N., R. 11 W., in the Liberty mining district, 2 miles west of Sawyer's Bar in the Klamath Reserve. Owners, Geeshan & Kellner; comprises 20 acres on the Klamath River; slate bedrock; 50 feet of gravel; water from North Fork of Salmon River through 1½-mile flume; one giant, 1200 feet of pipe and derrick; has been a good producer; worked on a small scale during the winter.

Gold Hill, in Secs. 28 and 29, T. 40 N., R. 11 W., in the Liberty mining district, in town of Sawyer's Bar in the Klamath Reserve. Owners, G. W. and O. R. Bigelow; comprises 80 acres on North Fork of Salmon River; slate bedrock; 10 to 80 feet of gravel; water from Eddy's Gulch through 2 miles of ditch; three giants, 1200 feet of pipe and hand derrick; good producer; operated during the winter when water is plentiful.

Gordan, in Sec. 17, T. 18 N., R. 7 E., in the Happy Camp mining district, 5 miles northeast of Happy Camp in Klamath Reserve. Owner,

C. Gordan; comprises 60 acres; schist bedrock; 30 feet of gravel; three men employed during operating season; yearly production about $4000.

Bibl.: Report XII, p. 283; XIII, p. 403.

Grider, in Secs. 12, 15, 10, 14 and 11, T. 46 N., R. 12 W., in the Seiad mining district, 9 miles southwest of Hamburg Bar in Klamath Reserve. Owner, J. B. Grider; comprises 245 acres, patented; on the Klamath River; schist bedrock; 10 to 40 feet of gravel; water from Grider Creek through 3-mile ditch of a capacity of 240 inches; equipment consists of dwellings, two giants and 1500 feet of pipe; operating season from four to five months; average production monthly of $2000. Idle at present on account of lack of water.

Bibl.: Report VIII, p. 600; XIII, p. 403.

Haley, formerly known as the *Halstead,* in Sec. 7, T. 16 N., R. 7 E., in the Happy Camp mining district, 10 miles southwest of Happy Camp in Klamath Reserve. Owner, M. Doolittle; comprises 40 acres of patented land; schist bedrock; 10 to 30 feet of gravel; some boulders and some cement. Idle for several years.

Bibl.; Report VIII, p. 601; XIII, p. 404.

Hammer, in Secs. 36, 1 and 4, T. 46 N., R. 11 W., in the Hamburg Bar mining district, ½ mile west of Hamburg Bar in the Klamath Forest Reserve. Owners, Johnson & Caldwell; comprises 60 acres along the Klamath River; schist bedrock; 30 to 40 feet of gravel; water from Kuntz and Mill creeks through a 3-mile ditch; four giants, 1000 feet of pipe, and dwelling; property leased; worked one month in 1913 and produced $400; some good ground. Idle at present.

Happy Home, formerly known as the Maplesden, in Sec. 31, T. 46 N., R. 10 W., in the Hamburg Bar mining district in the Klamath Forest Reserve, ¼ mile east of Hamburg Bar. Owner, Maplesden Brothers; comprises 40 acres on the Klamath River; schist bedrock; large portion of this ground has been worked; good pay on bedrock; two men are employed cleaning up the sluice boxes.

Bibl.: Report VIII, p. 594.

Hardscrabble, in Secs. 1 and 12, T. 44 N., R. 9 W., in the Deadwood mining district, 6 miles north of Fort Jones. Owner, J. D. Duane; comprises 20 acres, patented, on McAdams Creek; quartz-porphyry bedrock; 30 to 50 feet of gravel; water from McAdams Creek through a ditch 2 miles long; rich diggings years ago, worked by Chinese. Idle at present.

Bibl.: Report XIII, p. 404.

Hickey, in Secs. 24 and 25, T. 40 N., R. 12 W., in the Liberty mining district, 2 miles west of Sawyer's Bar in the Klamath Forest Reserve. Owners, Pike & Hickey; comprises 20 acres, patented, on North Fork of Salmon River; slate bedrock; 25 to 70 feet of gravel; water from North Fork of Salmon River through 3-mile ditch. Idle in 1913; small producer when operated.

Bibl.: Report XIII, p. 405.

Hi You, in Sec. 29, T. 44 N., R. 8 W., in the Deadwood mining district, 8 miles north of Fort Jones. Owners, Wyman and Richman; comprises 40 acres, patented, on Deadwood Creek; quartz-porphyry bedrock; 30 to 50 feet of gravel; water from Deadwood Creek through a ditch 1¼ miles long; two giants and 2000 feet of pipe; only worked a few times since 1905; good producer years ago.

Bibl.: Report XIII, p. 405.

Hooper Hill, formerly known as *Preckel,* in Sec. 21, T. 45 N., R. 10 W., in the Scott Bar mining district, ½ mile southeast of Scott Bar in the Klamath Reserve. Owner, H. Preckel; comprises 20 acres along Scott River; slate bedrock; 20 feet of gravel; water from Pat Ford Creek through 1 mile of ditch; equipment: one giant, 1100 feet of pipe and dwelling; worked on a small scale. Idle on account of lack of water.

Hoosier Hill, in Sec. 36, T. 46 N., R. 11 W., in the Hamburg Bar mining district, ½ mile west of Hamburg Bar in the Klamath Forest Reserve. Owner, C. L. Willard; comprises 32 acres of patented ground, located in 1856; bedrock is schist; 20 to 50 feet of gravel; two giants and 800 feet of pipe; rich ground worked years ago; leased, and only short season in 1913 due to shortage of water; small production.

Huey Hill, in Sec. 25, T. 18 N., R. 6 E., in the Happy Camp Mining district, 14 miles north of Happy Camp in Klamath Forest Reserve. Owner, D. Huey; comprises 40 acres, patented; schist bedrock; 20 feet of gravel; two giants and pipe; only worked in a limited way; small producer; some good gravel.

Bibl.: Report XIII, p. 407.

Imperial Heights, in Sec. 33, T. 40 N., R. 11 W., in the Liberty mining district, 2 miles south of Sawyer's Bar in the Klamath Forest Reserve. Owner, Ed Hickey; comprises 40 acres on North Fork of Salmon River; slate bedrock; 20 to 80 feet of gravel; water from Shellatoe Gulch through 2-mile ditch; 2 giants, 1700 feet of pipe and derrick; operated during the winter; small producer.

Jack Lowden, in Sec. 13, T. 46 N., R. 12 W., in the Seiad mining district, 10 miles west of Hamburg Bar in the Klamath Reserve. Owner, J. S. Lowden; comprises 140 acres of patented land along the Klamath River; slate bedrock; 5 to 40 feet of gravel; water from

Walker Creek through 2½-mile ditch of 1500 inches capacity; one giant and 2500 feet of pipe; four to five month operating season; good ground.

Joe Ramus, in Sec. 6, T. 45 N., R. 10 W., in the Scott Bar mining district, 3 miles north of Scott Bar, on Scott River in the Klamath Forest Reserve. Owner, G. A. Milne; comprises 60 acres; slate bedrock; 20 feet of gravel; water from Tom Creek; through 2½ miles of ditch; equipment: two giants and 1000 feet of pipe; yearly production about $7500; worked years ago by rocker and said to have produced $500,000; two men employed at present; idle on account of lack of water; some good ground.

Klein, formerly known as the *Casey,* in Sec. 4, T. 39 N., R. 11 W., in the Liberty mining district, 2½ miles south of Sawyer's Bar in the Klamath Forest Reserve. Owner, Woodfill & Luddy; comprises 50 acres; slate bedrock; 30 feet of gravel; water from Eddy's Gulch through ½ mile of ditch; one giant and 500 feet of pipe; worked on a small scale during the winter; small producer.

Bibl.: Report XII, p. 286; XIII, p. 411.

Lowden, formerly known as *McCreary,* in Secs. 2 and 35, T. 45 and 46 N., R. 11 W., in the Hamburg mining district, ½ mile south of Hamburg Bar in the Klamath Forest Reserve. Owner, J. S. Lowden; comprises 60 acres, 20 of which are patented, and follows the course of the Klamath River; schist bedrock; 10 to 40 feet of gravel; water from Tom Creek through a ditch 2 miles long; two giants and 1000 feet of pipe; worked on a small scale; idle on account of scarcity of water.

Bibl.: Report XII, p. 286; XIII, p. 413.

McGuffey, in Sec. 16, T. 45 N., R. 10 W., in the Scott River mining district, in town of Scott Bar in Klamath Forest Reserve. Owner, T. G. McGuffey; comprises 40 acres, on Scott River, located in 1873; slate bedrock; 20 to 40 feet of gravel; equipment consists of two giants, and 600 feet of pipe; worked on a small scale; has been a good producer.

Bibl.: Report XII, p. 287; XIII, p. 415.

Michigan-Salmon, formerly known as the *Red Hill,* in Secs. 19, 20, 21 and 28, T. 10 N., R. 8 E., 1½ miles east of Forks of Salmon in the Klamath Forest Reserve, is one of the noted hydraulic mines in the Liberty district, and comprises 600 acres, 40 of which are patented. It is owned by the Michigan-Salmon Mining Company of Detroit, Mich.; president, S. Stevens; secretary, George Whitworth; superintendent, L. E. Taggett. These holdings, extending along the Salmon River for a distance of 2½ miles, consisting of old river bars and benches, include the well known Red Hill, Missouri Bar, Cash, Clovis and Rocky Bar placers, which were good producers during pioneer mining days. The general course of the channel is southwest; depth of gravel 20 feet; bedrock consists of slate and schist; about 60 acres have been worked; water is obtained from Knownothing Creek through 1 mile of ditch and 3 miles of flume, having a capacity of 40 inches; the equipment consists of two Ruble elevators (which are 90 feet long, 8½ feet wide and pitch at an angle of 17°), dwellings, three giants, pipe, etc.; six men employed continually and twelve during operating season of seven months; operating cost about $12,000 per year; good profit made from operations.

Bibl.: Report VIII, p. 615; XII, p. 290; XIII, p. 422.

Milich, in Sec. 2, T. 10 N., R. 7 E., in the Liberty mining district, 5 miles northwest of Forks of Salmon. Owner, P. Milich; comprises 20 acres; schist bedrock; 30 feet of gravel; water from Crapo Creek through 1½-mile ditch. Idle since 1911.

Bibl.: Report XII, p. 288; XIII, p. 415.

Native Son, in Sec. 13, T. 10 N., R. 7 E., in the Liberty mining district, 1 mile northeast of Forks of Salmon in the Klamath Forest Reserve. Owner, M. L. Mills; comprises 20 acres; schist bedrock, coarse gold being found on same; 30 feet of gravel; adjoins Forks of Salmon mine; only short season's run on account of lack of water; some good gravel.

Nordheimer, formerly known as *McNeal,* in Sec. 3, T. 10 N., R. 7 E., 5 miles southwest of Forks of Salmon in Klamath Forest Reserve. Owners, Nordheimer Mining Company; H. B. Morey of Menlo Park, secretary; Ed Kingston, superintendent; comprises 60 acres of patented land on Salmon River; schist bedrock; 15 to 25 feet of gravel; equipment two giants, pipe and dwellings; five men employed at rate of $3 per day; has been a good producer. Idle on account of lack of water.

Bibl.: Report VIII, p. 611.

The Pine Grove, hydraulic mine, in Sec. 10, T. 46 N., R. 9 W., in the Oak Bar mining district; is one of the famous placer properties on the Klamath River. It is 28 miles west of Hornbrook at an elevation of 2600 feet and comprises an old river bar containing 100 acres. The pay gravel is over 1000 feet wide in places, with a depth of 18 feet and a northeast and southwest course, following the south bank of the Klamath River. The bedrock is schist of medium hardness, and coarse gold is found here. It was formerly worked with hydraulic elevators, but at present a drag scraper is used to convey the gravel to the sluice boxes, a 2-reel steam hoist being attached to the scraper. Water for the sluice boxes is pumped from the river. Wood is the fuel used. The owner, H. H. Barton, has bonded this group to W. B. Carlock, of San Francisco; eight men are employed; about 30 acres have been worked and some of this ground, removed years ago, was very rich. From a pit 100 feet square on bedrock, at a depth of 18 feet, over $6000 was taken out. In one day $300 of bedrock pay was panned out.

Bibl.: Report VIII, p. 592.

Portuguese, in Sec. 4, T. 46 N., R. 12 W., in the Seiad mining district, 12 miles west of Hamburg Bar in the Klamath Forest Reserve. Owner, H. Wood; comprises 140 acres of patented land along the Klamath River; schist bedrock; 20 to 50 feet of gravel, with from 4 to 10 feet of cemented gravel in places, requiring blasting; water is obtained from Portuguese Creek through 1½-mile ditch; equipment consists of three No. 2 giants, dwellings and 2500 feet of pipe; yearly production from $10,000 to $15,000; about 30 acres have been worked to date; bonded to Jerome Mining Company, of San Francisco. Idle on account of lack of water.

Bibl.: Report VIII, p. 595; XII, p. 290; XIII, p. 420.

Quartz Gulch, formerly known as *Wingate Hill,* in Secs. 5 and 6, T. 15 N., R. 7 E., in the Happy Camp mining district, 8 miles southwest of Happy Camp in the Klamath Forest Reserve. Owner, J. H. Wells; comprises 40 acres of patented land; slate bedrock, 10 to 20 feet of gravel. Idle for several years; good producer at one time.

Bibl.: Report VIII, p. 601.

Russian Hill, formerly known as *Russian Dump, Ahlgren* and *Red Hill,* in Secs. 23 and 24, T. 40 N., R. 12 W., in the Liberty mining district, 5 miles west of Sawyer's Bar. Owner, A. Ahlgren; comprises 80 acres on North Fork of Salmon River; slate bedrock; 40 to 80 feet of gravel; water from North Fork of Little Salmon River, through 3-mile ditch; two giants, 2800 feet of pipe and derrick; good producer, having been worked since the eighties; operated during the winter.

Bibl.: Report XII, p. 276; XIII, p. 386.

Rycroft, in Sec. 14, T. 39 N., R. 9 W., in the Callahan mining district, 6½ miles southwest of Callahan in the Klamath Forest Reserve. Owner, S. Rycroft; comprises 60 acres, on Slide Creek; schist bedrock; 20 to 40 feet of gravel; two giants and 1000 feet of pipe; considerable gold extracted in past years. Idle. Do only assessment work.

Bibl.: Report XIII, p. 423.

Sauer Kraut, in Sec. 34, T. 11 N., R. 7 E., in the Liberty mining district, 9 miles southwest of Forks of Salmon in Klamath Forest Reserve. Owners, Chinese Company; comprises 40 acres of patented land; slate bedrock, 15 feet of gravel; produces about $2000 per year;

rich gravel in the early days. Idle on account of lack of water; use two No. 2 giants.

Bibl.: Report XII, p. 291; XIII, p. 424.

Seiad, in Sec. 11, T. 46 N., R. 12 W., in the Seiad mining district, 9½ miles west of Hamburg Bar in Klamath Forest Reserve. Owner, T. K. Towne; comprises 60 acres along the Klamath River; schist bedrock; 5 to 20 feet of gravel; water from Seiad Creek through 2-mile ditch; giant and pipe; do only assessment work.

Siskiyou Klondike, in Secs. 15 and 16, in the Oak Bar mining district, 24 miles west of Hornbrook in Klamath Forest Reserve. Owner, H. H. Barton; comprises 40 acres; bedrock schist; 10 feet of gravel; 2-mile ditch from McKinney Creek; located in 1865; some production. Idle.

Siskiyou Mines Company, in Secs. 2, 1, 6, 7, 5, 12 and 18, T. 16 and 17 N., R. 7 and 8 E., in the Happy Camp mining district, in town of Happy Camp, is the largest hydraulic mine in this section. It is owned by the Siskiyou Mines Company, of New York City; Dr. Harbeck, president; C. A. Gardiner, secretary, and W. A. Maguire, superintendent. These holdings, comprising 1500 acres, of which 640 are patented, follow the Klamath River and include several famous old placer claims which were rich and which were only superficially worked by the early miners. The general course of the channel is northwest and southeast; bedrock is schist; gravel from 10 to 60 feet deep, consisting of bars and benches; water is obtained from Thompson Creek, through 3 miles of ditch and 10 miles of flume; equipment consists of five giants, several thousand feet of pipe and dwellings; ten men employed at present; operating expenses are heavy during the season.

Siskiyou River Bend, formerly known as the *Lou Daggett,* and containing 20 acres, has been worked for many years and considerable gold extracted. It is in Sec. 9, T. 46 N., R. 9 W., 30 miles west of Hornbrook, in the Oak Bar mining district, at an elevation of 2700 feet. The bedrock is schist; gravel from 20 to 50 feet deep with 10 feet of pay. The present owner, A. C. Aiken, of San Francisco, has spent considerable time and money experimenting on methods of working the ground; during the last season's run of three months $15,000 was produced. Evans hydraulic elevator is used, water being obtained from Buckhorn Creek through a ditch 9 miles in length.

Slumway, in Sec. 3, T. 10 N., R. 7 E., in the Liberty mining district, 4½ miles northwest of Forks of Salmon in Klamath Forest Reserve. Owner, Bennett Company; comprises 40 acres of patented ground; schist bedrock; 30 feet of gravel; water from Slumway Creek, through 3-mile ditch. Idle since 1910.

Squaw Gulch, also known as *French John,* in Sec. 1, T. 40 N., R. 9 W., in the Callahan mining district; 4 miles northwest of Callahan, in the Klamath Reserve. Owner, D. L. Jones; comprises 60 acres; schist bedrock; 30 feet of gravel; two giants and 800 feet of pipe; water from Sugar Creek through a ditch 9 miles long, carrying 800 inches; worked only in winter; small producer; worked years ago as a drift mine and some rich gravel removed.

Sturn, formerly known as the *Colby,* in Sec. 2, T. 16 N., R. 7 E., in the Happy Camp mining district, 1 mile north of Happy Camp in the Klamath Forest Reserve. Owner, G. H. Compton; comprises 200 acres of patented land, on old river channel; schist bedrock; equipment consists of small reservoir to collect surface waters, 2 miles of ditch, one giant, and 1000 feet of pipe; production $2000 per season of three months; lack of water limits mining operations; good ground.

Ten Eyck, in Sec. 28, T. 12 N., R. 6 E., in the Liberty mining district, 3 miles northwest of Somes Bar. Owner, W. Lord; comprises 80 acres, slate bedrock; coarse gold found in bedrock crevices; two giants; good producer for a number of years; yearly production said to exceed $20,000; fifteen men employed during season; four men working at present; water from Ten Eyck Creek.

Bibl.: Report VIII, p. 605; XIII, p. 430.

Thomain, in Sec. 5, T. 39 N., R. 11 W., in the Liberty mining district, 4 miles southeast of Sawyer's Bar in the Klamath Forest Reserve. Owners, F. and C. F. Thomain; comprises 20 acres, on Eddy's Gulch; slate bedrock; 10 to 30 feet of gravel; water from Eddy's Gulch through 1 mile of flume; one giant and 800 feet of pipe; operated only during the winter; small producer.

Two and a Half, formerly known as the *Walker,* in Sec. 20, T. 40 N., R. 7 W., in the Callahan mining district, 6 miles east of Callahan, in the Klamath Reserve. Owner, W. Walker; comprises 40 acres, on Grouse Creek; bedrock is schist; 10 to 20 feet of gravel; water from Grouse Creek through a ditch 2½ miles long carrying 600 inches; two giants and 600 feet of pipe. Idle at present; said to have produced $200,000.

Willard, in Sec. 30, T. 46 N., R. 11 W., in the Hamburg Bar mining district, ¾ mile south of Hamburg Bar in the Klamath Reserve. Owners, Willard & Hickman; comprises 20 acres along the Klamath River; schist bedrock; 30 to 50 feet of gravel; water obtained from Max Creek through 1-mile ditch; one giant and 500 feet of pipe. Only worked in a small way.

Bibl.: Report XII, p. 294; XIII, p. 432.

Wm. Burns, in Sec. 33, T. 39 N., R. 11 W., in the Liberty mining district, 2 miles southeast of Sawyer's Bar in the Klamath Reserve. Owner, J. R. Peterson; comprises 20 acres, patented; slate bedrock; 10 to 30 feet of gravel; one giant, 500 feet of pipe and a derrick. Worked during the winter season; small producer.

Windeler, in Sec. 20, T. 40 N., R. 11 W., in the Liberty mining district, 1 mile north of Sawyer's Bar in the Klamath Reserve. Owner, J. C. Windeler; comprises 20 acres on Jackass Gulch; slate bedrock; 30 feet of gravel; one giant and 500 feet of pipe; some coarse gold found on bedrock. Little work during the winter; small producer.

Wood & Fehely, in Sec. 4, T. 46 N., R. 12 W., in the Seiad mining district, 11 miles west of Hamburg Bar in the Klamath Reserve. Owners, Wood & Fehely; comprises 60 acres, patented, on the Klamath River; slate bedrock, best values being found in the soft bedrock; 10 to 30 feet of gravel; water from Thompson Creek through a ditch 1½ miles long; three giants and 1800 feet of pipe; employ four men during the season. Idle in 1912; good ground; has been a steady producer.

Bibl.: Report XIII, p. 432.

Wright & Fletcher, in Secs. 7 and 8, T. 43 N., R. 9 W., in the Oro Fino mining district, 4 miles northeast of Greenview. Owners, Wright Brothers; comprises 80 acres; bedrock is quartz-porphyry; 20 to 60 feet of gravel; water from Kidder Creek through two ditches, one 9 miles long, also furnishes power for the Johnson mill, and the other, 4½ miles in length, for the hydraulic operations; two giants and 2100 feet of pipe; best ground has been worked and yielded a good production; property only worked on a small scale. Idle on account of lack of water.

Bibl.: Report VIII, p. 609; XII, p. 294; XIII, p. 433.

GOLD MINES—GROUND SLUICING.

The extraction of gold from placer deposits by means of ground sluicing is pursued to a limited extent in the Hawkinsville, Oak Bar, Greenhorn, and Liberty mining districts.

Anderson, in Sec. 33, T. 39 N., R. 11 W., in the Liberty mining district, 1¾ miles southeast of Sawyer's Bar in the Klamath Forest Reserve. Owners, Peterson Brothers; comprises 20 acres on Eddy's Gulch; slate bedrock; 20 to 30 feet of gravel; water from continuation of Burns' flume, 1 mile in length; adjoins Burns' placer; worked on a limited scale during the winter; small producer.

Bibl.: Report VIII, p. 617.

Baines, in Sec. 13, T. 39 N., R. 12 W., in the Liberty mining district, 10 miles southwest of Sawyer's Bar in the Klamath Forest Reserve. Owner, G. A. Baines; comprises 20 acres on Bear Creek; slate bedrock;

10 to 20 feet of gravel; water from Bear Creek through ½ mile of flume; worked during the winter on a limited scale; small producer.

Beaver Creek, in Secs. 30 and 31, T. 47 N., R. 7 W., in the Virginia Dale mining district, 2 miles northwest of Gottville on Beaver Creek in Klamath Reserve. Owner, J. E. Jones; comprises 160 acres, patented; slate bedrock; 5 feet of gravel. Idle for several years.

Beaver Creek, in Sec. 6, T. 46 N., R. 8 W., in the Oak Bar mining district; 28 miles west of Hornbrook. Owners, Païnes & Barton; 104 acres patented; 15 feet of gravel; schist bedrock. Idle.

Big Slide, in Sec. 19, T. 46 N., R. 8 W., in the Oak Bar mining district, 28 miles west of Hornbrook in the Klamath Forest Reserve. Owner, E. F. Rider; comprises 20 acres of land; schist bedrock; 10 feet of gravel. Idle.

Brazil, in Sec. 11, T. 45 N., R. 7 W., in the Hawkinsville mining district, 3 miles west of Yreka. Owner, A. Brazil; in Klamath Forest Reserve; 80 acres, located in 1856; water from Greenhorn ditch; 10 feet of gravel; slate bedrock; small output.

Bibl.: Report VIII, p. 612; XIII, p. 391.

Buckeye Bar, formerly known as *Jackson*, in Sec. 9, T. 46 N., R. 9 W., in Oak Bar mining district, 26 miles west of Hornbrook. Owners, Jackson Brothers; in Klamath Reserve; bedrock is schist; gravel is 10 feet deep. Idle on account of lack of water; 2 miles of ditch from McKinney Creek; contains 60 acres.

Bibl.: Report VIII, p. 592; XII, p. 279; XIII, p. 391.

Canal Gulch, in Sec. 4, T. 45 N., R. 7 W., in Hawkinsville mining district, 3 miles north of Yreka. Owner, W. Koester; in Klamath Forest Reserve; 20 acres, located in 1876; worked in spring; only little water; 10 feet of gravel; slate bedrock.

Enterprise, in Sec. 16, T. 46 N., R. 9 W., in Oak Bar mining district, 24 miles west of Hornbrook. Owner, R. J. Fenile; in Klamath Forest Reserve; 40 acres of ground; schist bedrock; 10 feet of gravel. Idle.

Indian Bar, in Sec. 30, T. 11 N., R. 7 E., 6 miles northeast of Forks of Salmon in Klamath Forest Reserve. Owners, Ayles & Dunn; comprises 40 acres; schist bedrock; 15 feet of gravel. Idle; only do assessment work.

Bibl.: Report XII, p. 277; XIII, p. 407.

John Miller, in Sec. 3, T. 45 N., R. 7 W., in Hawkinsville mining district, 4 miles north of Yreka. Owner, J. A. Tiexeria; in Klamath Forest Reserve; 40 acres patented; 10 feet of gravel; slate bedrock. Idle for several years.

Bibl.: Report XIII, p. 409.

McKinney Creek, in Sec. 9, T. 46 N., R. 9 W., in Oak Bar Mining district, 26 miles west of Hornbrook. Owners, S. H. and S. R. Crary; in Klamath Forest Reserve; contains 40 acres; schist bedrock; 12 feet of gravel; water from McKinney Creek through a ditch 2½ miles long.

O'Donnell, in Secs. 3, 4 and 10, T. 45 N., R. 7 W., in Hawkinsville mining district, 3 miles north of Yreka. Owner, Mrs. O'Donnell; in Klamath Forest Reserve; 45 acres patented; worked since 1856; slate bedrock; 10 to 20 feet of gravel; small production.

Bibl.: Report XIII, p. 418.

Paine, in Sec. 21, T. 46 N., R. 9 W., 28½ miles west of Hornbrook in the Oak Bar mining district in the Klamath Forest Reserve. Owner, A. A. Paine; schist bedrock; 8 feet of gravel; comprises 20 acres. Idle.

Santana Brothers, in Sec. 11, T. 45 N., R. 7 W., in Hawkinsville mining district, 2½ miles north of Yreka. Owners, Santana Brothers, formerly known as Joe Lemois; 60 acres located in 1856; 7 feet of gravel; slate bedrock; small production. Idle until spring.

Bibl.: Report XIII, p. 424.

Simas & Rose, in Sec. 25, T. 45 N., R. 8 W., in Greenhorn mining district, 4½ miles west of Yreka. Owners, Simas & Rose; in Klamath Forest Reserve; 160 acres patented; located in 1870; 8 feet of gravel; slate bedrock; 2 miles of ditch; season from February to June. Idle.

Sylvester Ramus, in Sec. 11, T. 45 N., R. 7 W., in Hawkinsville mining district, 2½ miles north of Yreka. Owner, S. Ramus; in Klamath Forest Reserve; 87 acres; water from lower Greenhorn ditch, 6 miles long; 5 feet of gravel; slate bedrock. Idle; worked each spring; small output.

Sulphur Springs, in Sec. 18, T. 47 N., R. 7 W., in the Virginia Bar mining district, 7 miles north of Gottville, on Empire Creek in Klamath Forest Reserve. Owner, E. Campbell; comprises 20 acres; schist bedrock; 3 to 5 feet of gravel; only small production in 1912.

Tom Rogers, in Sec. 11, T. 45 N., R. 7 W., in Hawkinsville mining district, 2 miles north of Yreka. Owner, Phillips Brothers; in Klamath Forest Reserve; 113 acres, patented; discovered in 1860; water from Greenhorn Creek; short season. Idle since May; 5 to 10 feet of gravel; slate bedrock.

Bibl.: Report XIII, p. 430.

GOLD MINES—DRIFT.

Allgood & Castell, in Sec. 12, T. 11 N., R. 7 E., in the Liberty mining district, 3 miles southeast of Somes Bar. Owners, Allgood & Castell; comprises 40 acres; slate bedrock; 30 feet of gravel. Idle; some rich gravel worked at one time.

Ascondry, in Sec. 10, T. 46 N., R. 9 W., in Oak Bar mining district, 27 miles west of Hornbrook. Owner, W. Quingley; contains 100 acres; 50-foot shaft; schist bedrock; 8 feet of gravel. Idle.

California Bar, in Sec. 18, T. 46 N., R. 6 W., in the Cottonwood mining district, 9 miles southwest of Hornbrook in Klamath Forest Reserve. Owners, Vene Gold Bar Mining Company; comprises 20 acres on old river bar; bedrock is slate; old shafts caved. Idle at present; water from Klamath River through a ditch 1½ miles long; some good ground.

Bibl.: Report XIII, p. 391.

Consolidated Sciwash, in Sec. 6, T. 44 N., R. 8 W., in the Deadwood mining district, 6 miles north of Fort Jones. Owner, H. Madison; comprises 90 acres, patented, on McAdams Creek; quartz-porphyry bedrock; 30 feet of gravel; 450-foot tunnel, and three 50-foot shafts (all caved); good producer at one time. Idle for a number of years.

Bibl.: Report XIII, p. 395.

Deep Channel, formerly known as *Taylor & Maplesden,* in Sec. 36, T. 46 N., R. 11 W., in the Hamburg Bar mining district, ⅛ mile west of Hamburg Bar in the Klamath Forest Reserve. Owner, Deep Channel Mining Company, of Portland, Oregon; president, J. L. McKittrick; comprises 40 acres on the Klamath River; schist bedrock; gravel is from 20 to 50 feet deep; 100-foot tunnel 5′ x 7′ and 60-foot shaft, 4′ x 6′ (abandoned). Idle during 1913; some good ground and has been a steady producer.

Bibl.: Report XII, p. 293; XIII, p. 429.

Doolittle, in Sec. 5, T. 17 N., R. 8 E., in the Happy Camp mining district, 6 miles northeast of Happy Camp in the Klamath Forest Reserve. Owner, M. Doolittle; comprises 40 acres of patented land along the Klamath River; schist bedrock; 30 feet of gravel; 120-foot tunnel, 5′ x 7′. Idle; producer at one time.

Bibl.: Report XIII, p. 404.

Elk Creek, in Sec. 15, T. 16 N., R. 7 E., in the Happy Camp mining district, 1 mile southwest of Happy Camp in the Klamath Reserve. Owners, Chinese Company; comprises 60 acres along the Klamath River; schist bedrock; 10 to 40 feet of gravel; 220-foot tunnel, 5′ x 7′; paid well at one time. Idle at present.

Bibl.: Report XII, p. 281; XIII, p. 398.

Empire Bar, in Sec. 2, T. 46 N., R. 7 W., in the Virginia Dale mining district, in town of Gottville, in the Klamath Reserve. Owners, an incorporated company; comprises 20 acres, patented; slate bedrock;

5 to 8 feet of gravel; old shafts; small steam hoist; worked by leasers at times, but idle at present; has been a good producer.

Bibl.: Report VIII, p. 589.

Evans, formerly known as the *Berry*, in Sec. 17, T. 8 N., R. 7 E., in the Happy Camp mining district, 5½ miles northeast of Happy Camp in the Klamath Reserve. Owner, C. A. Evans; comprises 20 acres; bedrock is schist, with quartz stringers running through it; depth of gravel is 40 feet; 60 feet tunnel, 5′ x 7′ feet; only do assessment work; small producer at one time.

Everill, in Sec. 26, T. 46 N., R. 11 W., in Hamburg Bar mining district, 4 miles southwest of Hamburg Bar. Owner, J. H. Everill; comprises 40 acres on the Klamath River; bedrock is slate; 120-foot tunnel on bedrock; old 60-foot shaft; equipment: dwelling, derrick, pipe, sluice boxes; good ground; leased to an incorporated company; T. C. Williams, superintendent; three men employed.

Bibl.: Report XII, p. 281; XIII, p. 400.

French Bar Placer, in Sec. 17, T. 46 N., R. 10 W., in the Scott River mining district, ½ mile northwest of Scott Bar, in the Klamath Forest Reserve. Owner, Z. E. Russell; comprises 20 acres, on Scott River; slate bedrock; 20 feet of gravel; 40-foot tunnel, 5′ x 7′; only do assessment work.

Gold Lead, in Sec. 8, T. 45 N., R. 10 W., in the Scott River mining district, 1¼ miles north of Scott Bar in the Klamath Reserve. Owner, M. Andrews; comprises 20 acres on the Scott River; slate bedrock; 10 to 20 feet of gravel; water from Tom Creek through 1 mile of ditch; 90 feet tunnel (5′ x 7′), on bedrock; equipment: car, blacksmith shop, mining tools; one man employed at $3 per day; production generally about $4000 (five months run); some coarse gold found on the bedrock; easy ground to work.

Klamath River Gold Mining Company, in Sec. 15, T. 46 N., R. 7 W., in the Cottonwood mining district, 12 miles southwest of Hornbrook in Klamath Forest Reserve. Owners, Klamath River Gold Mining Company; comprises 20 acres on old bar of Klamath River; bedrock is slate; gravel 5 to 20 feet deep; old shafts to bedrock; company spent considerable money without any return. Idle.

Lucky Bob, in Sec. 2, T. 46 N., R. 7 W., in the Virginia Dale mining district, in town of Gottville. Owners, Freshour Brothers; comprises 40 acres, being a bench and bar along the Klamath River; slate bedrock; 7 feet of gravel; old shafts from 30 to 50 feet deep; good producer years ago; worked by leasers at times, but idle at present.

Bibl.: Report XII, p. 287; XIII, p. 413.

McMahon, in Sec. 25, T. 40 N., R. 9 W., in the Callahan mining district, 3 miles southeast of Callahan in the Klamath Reserve. Owner, C. A. Crowley; comprises 40 acres, on the Scott River; schist bedrock; good pay in the soft spots; 150-foot tunnel; old 40-foot shaft (caved); worked a little during the winter; small producer.

Bibl.: Report XII, p. 287; XIII, p. 415.

Miller, in Sec. 34, T. 44 N., R. 9 W., in the Callahan mining district, 5 miles southeast of Callahan in the Klamath Reserve. Owners, Jackson & Biedenbeck; comprises 20 acres; schist bedrock; 40 feet of gravel; 2 tunnels 100 and 60 feet in length on the bedrock; water from Jackson Creek through ½ mile of flume; no production since 1911; some good ground.

Bibl. Report XIII, p. 415.

Montezuma, in Sec. 20, T. 40 N., R. 8 W., in the Callahan mining district, in town of Callahan in the Klamath Reserve. Owner, Hop-yick; comprises 20 acres on the Scott River; schist bedrock; 20 to 50 feet of gravel; Chinese working over an old dump; noted producer years ago; best ground worked out.

Bibl.: Report VIII, p. 612; XII, p. 288; XIII, p. 416.

Paradise Flat, in Sec. 29, T. 40 N., R. 11 W., in the Liberty mining district, ⅛ mile west of Sawyer's Bar in the Klamath Reserve. Owner, A. Meyers; comprises 40 acres, patented, along the North Fork of the Salmon River; slate bedrock; 10 to 50 feet of gravel; old bench; 1000-foot tunnel; only worked on a small scale; said to have produced $140,000; seems to be a second bench, carrying good pay.

Poverty Point, in Sec. 18, T. 46 N., R. 9 W., in the Oak Bar mining district, 32 miles west of Hornbrook on Klamath River. Owner, H. H. Barton; 200 acres (40 acres patented); located in 1876; in Klamath Reserve; country rock, schist and diorite; 20 feet of gravel; 2400-foot tunnel (caved); produced $23,000. Idle for ten years.

Bibl.: Report VIII, p. 592; XIII, p. 420.

Schuler, in Sec. 16, T. 45 N., R. 10 W., in the Scott River mining district in the town of Scott Bar in the Klamath Reserve. Owner, M. Schuler; comprises 20 acres on Scott River; slate bedrock; 20 to 30 feet of gravel; 60 feet tunnel in river bank; only do assessment work; some rich ground worked at one time.

Bibl.: Report XIII, p. 425.

Sugar Hill, in Sec. 20, T. 40 N., R. 8 W., in the Callahan mining district, 5 miles southwest of Callahan in the Klamath Reserve. Owner, G. W. Smith; comprises 40 acres on Fox Creek; schist bedrock, coarse gold being found in crevices in this bedrock; 320-foot tunnel, 40-foot shaft (caved); 20 to 40 feet of gravel, loose. Idle; only do assessment work; some good pay extracted years ago.

Bibl.: Report VIII, p. 611.

Whistle Bar, formerly known as the *Blake,* in Sec. 29, T. 40 N., R. 11 W., in the Liberty mining district, at Sawyer's Bar in the Klamath Forest Reserve. Owner, E. Curran; comprises 20 acres on the North Fork of the Salmon River; slate bedrock; 30 to 100 feet of gravel, loose; 400-foot tunnel, 3′ x 7′; good producer at one time. Idle at present; only do assessment work; about one half of the gravel has been worked.

Bibl.: Report VIII, p. 616.

Wilson, in Sec. 29, T. 44 N., R. 8 W., in the Deadwood mining district, 8½ miles north of Fort Jones. Owner, F. L. Wilson; comprises 40 acres on Deadwood Creek; quartz-porphyry bedrock; 30 feet of gravel; water from Deadwood Creek through ½-mile of ditch; 320 feet bedrock tunnel and 50-foot shaft (caved); best ground has been worked; only do assessment work.

Bibl.: Report XIII, p. 432.

GOLD DREDGING.

Only one dredge in operation in Siskiyou County during the year 1913. This boat, owned by the Siskiyou Dredging Company, is working on McAdams Creek, some 5 miles north of the town of Fort Jones.

The Scott River Dredging Company operated a dredge on the Scott River near Callahan during 1908 and 1909. The project was finally abandoned and the machinery sold to the Trinity Dredging Company, and hauled to Trinity Center, Trinity County, where it was installed.

Bibl.: Bull. No. 57, p. 221.

The Northern California Dredge Company, owning several acres of land along the Klamath River in Sec. 36, T. 46 N., R. 11 W., M. D. M., about ½ mile west of Hamburg Bar, endeavored to work their land by means of a suction dredge, which proved a failure. The dredge has been idle since 1911.

Siskiyou Dredging Company, in Secs. 14, 6 and 35, T. 44 and 43 N., R. 8 and 9 W., in the Deadwood mining district, 5 miles north of Fort Jones, is the only dredge in operation in Siskiyou County. It is owned by the Siskiyou Dredging Company; G. J. Carr, president; J. C. Osgood, secretary; J. W. Boles, superintendent; home office is in San Francisco; comprises an area of 165.5 acres on McAdams Creek, 120 of which are patented, and includes the old Oak Grove, Diggles, Mathewson and

Shaw drift claims; course of the channel is north and south; quartz-porphyry bedrock; 30 to 60 feet of gravel, loose and easily removed; 2 miles of flume from McAdams Creek for water for floating dredge during the summer season; $5\frac{1}{2}$ cu. ft. Bucyrus type dredge with 98-foot digging ladder, and will handle gravel to a depth of 50 feet below the water level, and has a capacity of 2000 cubic yards per day or 154 yards per hour; 10 miles of power line; electricity from California-Oregon Power Company, costing $1\frac{1}{10}$ cents per cubic yard; ten men are employed; total operating cost per cubic yard is 6 cents; property acquired in 1909, and dredge has been operating since 1910; good dividends declared; about 20 acres have been worked.

Bibl.: Bull. No. 57, p. 223.

GRANITE.

The greater portion of the granite in Siskiyou County is too much shattered to be used for monument or building purposes. There is a large body of granite, however, on Craggy Mountain, T. 41 N., R. 8 W., from which some good building blocks have been obtained. Another deposit, southeast of Etna on Mill Creek in Sec. 1, T. 41 N., R. 9 W., contains some fine-grained stone that has been used for monument work. A similar grade of granite is found in the southwest and southeast corners of T. 40 N., R. 8 and 9 W.

Bibl.: Bull. No. 38, p. 54.

IRON.

Iron float is found in Sec. 10, T. 46 N., R. 10 W., on the north side of the divide between Buckhorn Creek and the Klamath River.

Bibl.: Bull. No. 38, p. 304.

LIMESTONE.

Two limestone deposits, one northeast of Greenview and the other southwest of Callahan, have been worked and the material has been converted into lime.

Bibl.: Bull. No. 38, pp. 92–93.

Burton, in Sec. 17, T. 43 N., R. 9 W., in the Oro Fino mining district, 4 miles northeast of Greenview. Owned by T. Martin; comprises 40 acres, discovered in 1889; large limestone deposit having a width of 1000 feet, but only 15 feet thick; limestone burned in kiln made of rocks, having the arch-shape form; capacity of kiln, 6 tons in five days; good grade of limestone; product produced upon demand.

Farrington, in Sec. 24, T. 40 N., R. 9 W., in the Callahan mining district, $2\frac{1}{2}$ miles southwest of Callahan. Owned by S. Farrington; comprises 20 acres, located in 1873; massive deposit of limestone; the

Photo No. 5. Marble Mountain, Siskiyou County.

extent not determined; surface stripped and limestone extracted from open cuts and burned in a small kiln of a capacity of 10 tons in four days; product is of splendid quality and was used in the hotel at Callahan; very little demand for the product. Idle.

Bibl.: Bull. No. 38, pp. 92–93.

MACADAM.

Steele Quarry, in Sec. 27, T. 45 N., R. 7 W., $\frac{3}{4}$ mile southeast of Yreka. Owned by J. M. Steele; comprises 100 acres, located in 1896; deposit just being opened up and its extent not determined as yet; plant consists of a crusher, operated by gasoline, cars, and mining tools; five men are employed; rock used on streets in Yreka.

MARBLE.

A belt of marble runs from a short distance west of Etna Mills, in a northwest direction along the eastern slope of the Salmon Mountains, forming, farther north, part of the Marble Mountains, and in the Grider Mountains showing north of the Klamath River on Thompson Creek, and running farther north into Oregon.

Bibl.: Report XIII, p. 632; Bull. No. 38, pp. 107-108.

Marble Mountain, a very large belt in Secs. 16, 19, 20 and 21, T. 43 N., R. 10 W., M. D. M., is a noted landmark; the limestone is metamorphosed, producing all varieties and colors of marble, but principally pure white. (See photo No. 5.)

Bibl.: Bull. No. 38, p. 107.

Barton & Barham, in Sec. 18, T. 46 N., R. 9 W., in the Oak Bar mining district; owned by Barton et al.; comprises 160 acres, located in 1913; massive deposit in schist; no work done on claims; marble is of the clouded variety, showing black streaks and probably of no commercial value.

Bibl.: Report XIII, p. 632.

Luce, in Sec. 41, T. 41 N., R. 8 W., in the Deadwood mining district, 3 miles north of Fort Jones. Owner, A. H. Luce; comprises 160 acres, patented, located in 1907; dike in schist, 300 feet wide and can be traced for 1500 feet, and is of good quality, taking a fine polish and easily worked; only small amount extracted from shallow cuts. Idle at present.

McDaniels, in Sec. 6, T. 41 N., R. 9 W., M. D. M., on road from Etna to Sawyer's Bar. Owned by R. McDaniels of Etna; seams of diabase through the marble and body of pure white marble much smaller than in the Parker deposit.

Bibl.: Report XIII, p. 632; Bull. No. 38, p. 107.

Parker, in Sec. 32, T. 42 N., R. 9 W., near Etna. Owned by A. Parker, Jr.; belt from 100 to 200 feet wide at elevation of 4000 feet; marble heavily bedded, in places being perfectly white and fine-grained, while in other places it is pink-colored and very coarsely crystalline; worked to a limited extent.

Bibl.: Bull. No. 38, p. 107.

Thompson Creek, in Sec. 8, T. 17 N., R. 8 E., H. M., in the Happy Camp mining district, 8½ miles northeast of Happy Camp on Thompson Creek. Owner, J. C. Wood; comprises 40 acres, located in 1890; large massive beds in schist and serpentine, few open cuts, so that extent of marble deposit not determined; it is hard and takes a good polish; the crystals are large, white and translucent. Idle.

Bibl.: Report XIII, p. 632.

MINERAL WATER.

Shasta Springs, on the Oregon branch of the Southern Pacific Railroad in Sec. 12, T. 39 N., R. 3 W., are owned by the Shasta Springs Mineral Water Company, and the only water from Siskiyou County on the market. These springs were first brought to notice during the construction of the railroad in 1887.

The three springs—Shasta, Glacier and Keystone—are all about 300 feet apart. The water has a temperature of 51° F., and contains considerable carbonic acid gas, magnesium, potassium, iron, and a little manganese, lithium and arsenate. The bedrock is tufa, overlaid with doleritic lava. The equipment consists of bottling works and dwellings.

Bibl.: Report XI, pp. 449–451; Mineral Springs of California, Anderson, p. 244.

Upper Soda Springs, in Sec. 24, T. 39 N., R. 4 W., 2 miles north of Dunsmuir. Owned by George McCloud; water is heavily charged with carbonic acid gas; formation is similar to the Shasta Springs section; water not on the market.

Bibl.: Report XI, p. 452; Mineral Springs of California, Anderson, p. 260.

Scott Springs, in Sec. 7, T. 39 N., R. 3 W., 3 miles north of Dunsmuir; water and formation similar to Shasta Springs. Owned by J. J. Scott & Company.

Bibl.: Report XI, p. 452.

Castle Crag Soda Springs, at Castle Crag. Owned by Pacific Improvement Company; water has a temperature of 53° F., and contains sodium, potassium, magnesium, calcium, with a trace of iron, silicia, alumina, manganese, barium, lithium, borates, ammonium carbonate; it is a well known summer resort.

Klamath Hot Springs, in Sec. 27, T. 48 N., R. 3 W., at Klamath Springs. Owned by Edson Estate; claimed good for rheumatism and blood diseases; several dwellings on the property.

Bibl.: Mineral Springs of California, Anderson, p. 183.

Siskiyou Mineral, in Secs. 33 and 34, T. 48 N., R. 9 W., 14 miles northwest of Walker. Owned by J. Garreston; water contains considerable iron and magnesia, and said to be good for blood diseases; conducted as a summer resort; several dwellings on the property.

Bibl.: Report XIII, p. 521.

Warmcastle Soda Springs, in Sec. 13, T. 39 N., R. 3 W., 1 mile south of Nabar. Owned by Estate of Judge Warmcastle; elevation is 3000 feet; water contains considerable soda.

ORNAMENTAL STONES.

Vesuvianite is found on the South Fork of Indian Creek, 12 miles north of Happy Camp, on land owned by Dr. A. E. Heighway; discovered in 1901; outcrops for 300 feet along the hillside, above the creek, and large masses have fallen into the bed of the creek below. It is a hard and handsome stone, olive to green in color, and takes a fine polish. The associated rock is serpentine; the rich translucent green color, fine-grained sub-splintery fracture and brilliant luster, when polished, strongly suggest jade, and many have called it by that name; deposit has not been worked. This variety of vesuvianite is also known as *californite.* F. H. Dakin of San Francisco also has claims covering portions of the deposit.

Bibl.: Bull. No. 37, pp. 93–94; Bull. No. 67, pp. 125–126.

Brusse, in Sec. 34, T. 17 N., R. 7 E., in the Happy Camp mining district, 3 miles north of Happy Camp on Indian Creek. Owned by F. A. Brusse; discovered in 1899; not in place, but pieces of float weighing several pounds found along the creek; associated with serpentine; resembles the Heighway mineral.

Griffin Onyx Quarries are situated 6 miles south of Berryvale. Specimens in the State Mining Bureau are 7355 and 8969.

Bibl.: Bull. 37, p. 112.

PLATINUM.

Small amounts of platinum are obtained with the gold in some of the placer mines of Siskiyou County, particularly on the streams traversing serpentine areas.

QUICKSILVER.

A cinnabar deposit in the northern part of the county on the headwaters of the West Fork of Beaver Creek above Oak Bar has been worked to some extent by the Siskiyou Quicksilver Mining Company. There is another small deposit on Horse Creek, which has not developed at all.

The holdings of the *Siskiyou Quicksilver Mining Company,* of San Francisco, comprise several acres on the headwaters of the West Fork of Beaver Creek, some 15 miles west of Cole's Station. The development consists of several hundred feet of tunnelling and drifts. The reduction plant consists of a 10-ton furnace. Idle for some time; had a small production.

Bibl.: Report XII, p. 370; XIII, p. 602; Bull. 27, p. 196.

Barton & Lange, in Sec. 22, T. 46 N., R. 9 W., in the Klamath Reserve, 4 miles west of Oak Bar in the Oak Bar mining district. Owners, Barton & Lange; comprises 60 acres of patented land, located in 1890; massive dike with no definite strike or dip; the country rock (schist and diorite), impregnated with cinnabar; deposit 160 feet wide and can be traced 2000 feet; short tunnel and open cuts comprise the workings; a few pounds (selected) of the semi-transparent crystals of cinnabar sold to Chinese for $4 per pound, to be used in paints and for medicinal purposes. Idle several years.

Bibl.: Report XIII, p. 602. Bull. No. 27, p. 196.

SANDSTONE.

A very extensive bed of sandstone runs along the east side of the Kildal Hills, Black Mountain Range, and Cottonwood Mountains, into Oregon; also found east of Yreka in two large exposures. It forms the rim of the Shasta Valley, having a northeast direction in Sec. 13, T. 45 N., R. 7 W., and also crops out a few miles south of Ager on the Herr ranch, where coal is found. Same belt exposed in the vicinity of Hornbrook in the ridges surrounding the valleys of the Klamath River and the lower part of Cottonwood Creek. A belt of fine-grained sandstone about ¼ mile in width west of Hornbrook along the rim of Cottonwood Creek forms a landmark, as its surface sloping east comprises the bare lower slope of the mountains, its gray color being distinguishable from a long distance; it is very fine grained, compact and hard, consisting of small granules of quartz, intermixed with some small ones of hornblende.

Bibl.: Bull. 38, pp. 139–140.

Antone, formerly known as the Weeks Quarry, in Sec. 2, T. 45 N., R. 7 W., 2 miles northeast of Yreka. Owned by Mrs. C. Antone; comprises 160 acres, patented, at an elevation of 2700 feet; occurs in stratified layers from 6 inches to 8 feet thick, and these sheets are pried from the deposit by hand; very little blasting needed; equipment at quarry consists of derrick of 2400 pounds capacity and mining tools; three men employed; stone of good quality, and has been used since 1860; new high school and other buildings in Yreka constructed with this stone; also used for tombstones; leased to J. P. Russell.

Fiock Bros. Quarry, in Sec. 13, T. 45 N., R. 7 W., near Yreka; considerable stone removed; face of the quarry shows massive sandstone, nearly horizontal, dipping slightly east; upper bed is 10 feet thick, coarse grained; of a very uniform texture, and tawny in color.

Bibl.: Bull. No. 38, p. 140.

Southern Pacific Railroad Company owns several quarries in Sec. 29. T. 47 N., R. 6 W., near Hornbrook; stone breaks in large blocks, some weighing 4 to 5 tons; quarries worked by plug and feather method; sandstone used in construction of Jones & Horn buildings in Hornbrook, built in 1888 and shows no signs of weathering.

Bibl.: Bull. No. 38, p. 140.

SOAPSTONE.

Talc is a hydrous silicate of magnesia (4 MgO, 5 SiO_2, H_2O) that occurs in different varieties, of which soapstone is one of the most important.

Soapstone is more compact and harder than talc and is used in the manufacture of many articles, such as bath and laundry tubs, switchboards for electrical plants, sinks, griddles and many other articles.

Talc is used as a powder, or flour talc, and as pieces sawed into various sizes and shapes. The flour talc is used in fireproof paints, electric insulators, boiler and steam pipe coverings, toilet powder, in the manufacture of powder and other articles.

Soapstone is found in several places in Siskiyou County, a large expose being noted in the northeast sections of T. 45 N., R. 11 W., southeast of Hamburg Bar, having a course of N. 50° E. and can be traced toward the ridge west of Scott River and is 50 feet wide; it is of good quality and resists the effect of fire for years in fireplaces; also used in sheets $\frac{1}{2}$ to $\frac{3}{4}$ of an inch thick for stove backs. There is another large belt south of Marble Mountain, in T. 13 N., R. 8 E., H. M., near the head of Wolley Creek.

Bibl.: Bull. No. 38, p. 352.

Talc is found in the Cottonwood Mountains, 30 feet wide, on the top of the divide between Beaver and Bumblebee creeks; it has no grit and the iron content gives it a light ochreous color; located by E. Caldwell of Hamburg Bar. A small exposure is found near Etna, in Sec. 32, T. 42 N., R. 9 W. Owned by J. Conners; it occurs in a serpentine belt and has no grit.

Bibl.: Bull. No. 38, p. 353.

SISKIYOU COUNTY.

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1904	165, 166, 168, 173, 177.
1905	164–169, 172, 182–184.
1906	178–185, 196, 197.
1907 (Part I)	189–194, 196, 198, 199, 226–228.
1908 (Part I)	316, 318–321, 324–325, 347, 349–353.
1909 (Part I)	261–265, 268, 269, 285, 286.
1910 (Part I)	349, 350, 352–354, 358, 359, 378, 379.
1911 (Part I)	465, 466, 468–470, 473–476, 500, 501.
1912 (Part I)	571, 572, 574–577, 584–586, 599, 602, 616, 630.

Mineral Resources West of the Rocky Mountains.

TRINITY COUNTY.

Field Work in October, 1913.

INTRODUCTION.

Trinity County, with an area of 3000 square miles, is bounded on the north by Siskiyou, on the east by Shasta and Tehama, on the south by Mendocino, and on the west by Humboldt County, and is drained by the Trinity, Mad, Eel and Van Dusen rivers.

Trinity is a mountainous county, its eastern third being covered by the Coast Range, or Trinity Mountains, the summit of which divides t from Tehama and Shasta counties. The mountain ranges of Scott and Salmon on the north form the boundary between it and Siskiyou. Bully Choop, Baldy and other peaks in the Trinity and Salmon Mountain ranges reach an altitude of over 6000 feet. The hydrography of this county is very simple, the Trinity River and its confluents draining all parts of it. This river, heading in the Scott Mountain division of the Coast Range, after flowing south for 60 miles, makes a detour to the northwest, which course it holds for another 60 miles, and unites with the Klamath River, in Humboldt County. From the section where Coffee Creek, one of the tributaries, flows into the Trinity, the great banks of auriferous gravel commence, parallel with the present river as far as Swift Creek, in Sec. 9, T. 36 N., R. 7 W. The river formerly flowed west of the town of Trinity Center, at an elevation of several hundred feet above its present channel, thence taking a southwesterly course through the Buckeye Range (T. 34 N., R. 9 W.), on to Weaver Basin.

Through this section, Trinity Center to Weaver Basin, is presented he only evidence of ancient river channels, the ancient river emptying nto a great lake at the present Weaver Basin. The material filling his channel is composed of volcanic breccia and rocks of all formations and ages—angular, irregular, rounded and intermingled with conglomerates, clay and sands.

The bed of Weaver Basin is a cement, several hundred feet in thickness below the auriferous gravel, deposited from the ferruginous, siliceous and calcareous matter carried down by the waters, erosions f the various formations along the channel settling in the basin, and there cementing. The absence of coarse material leads to the hypothesis that this cementation took place prior to the filling of the cement channel with auriferous sands and gravel.

Bibl.: Bull. No. 540, pp. 16–18, U. S. G. S.

GEOLOGY.

Scott Mountain, formed of igneous, volcanic rocks, with its showing of basalts, trachyte, and obsidian, overlaps the granite as shown in the Salmon Range to the west, its gray peaks towering above the timber line into the region of perpetual snow. On the east is the Trinity Range of granite, syenites, diabase and porphyries. Farther south on the range are metamorphic gneiss, hornblende and mica schists, then a slate belt, followed by a large belt of serpentine crossing in T. 38 N., R. 5 W.

HISTORY.

The first discovery of mineral in this county is attributed to Major Redding, in 1848, who prospected the Trinity River near Redding Creek (T. 32 N., R. 10 W.), and following his discovery came the prospectors from all sections, working the river bars, the ravines and gulches, extracting the gold from the gravel and sands by the rocker, tom and sluice. The evidence of these early workings can be seen along the course of almost every streamlet, creek, gulch and ravine tributary to the Trinity.

MINING CONDITIONS.

While Trinity County is lacking in railway facilities, the abundance of timber and water overcomes this handicap to a large extent.

Gold mining has been the principal industry for over fifty years, the placers giving Trinity County its wealth, and there are still many hundreds of acres of auriferous gravel awaiting exploration. Dredge mining is being successfully pursued at Trinity Center and Lewiston, and large areas in both these districts have recently been prospected for their dredging possibilities.

The La Grange, the largest active hydraulic mine in the world, is in this county.

Quartz mining is still in its infancy; quartz veins, carrying gold, are being prospected and worked in different sections; others that have been operated for several years have yielded and some are still yielding handsome returns to the owners; Dedrick, and the North and East Forks are the most active quartz districts at the present time, due to the installing of machinery and the development work on the Globe and Craig mines in the former section, and to the number of prospects being opened up in the North and East Fork territory.

The Brown Bear is the best known quartz mine in the county, and at one time was the largest producer.

MINERAL RESOURCES.

Its mineral resources consist of gold, silver, platinum, quicksilver, chromic iron, coal, copper, building stone and asbestos. The government records show a total mineral production of $150,000,000. Mineral production of Trinity County, from 1894 to 1913, inclusive, from records of California State Mining Bureau are as follows:

Substances	1894	1895	1896
Gold	$1,012,665 84	$1,166,745 13	$1,296,330 30
Silver	325 00	1,257 28	
Granite	5,000 00		
Quicksilver		137,410 00	139,035 00
Totals	$1,017,990 84	$1,305,412 41	$1,435,365 30

Substances	1897	1898	1899
Gold	$1,078,372 00	$859,255 00	$590,510 00
Silver	259 00	314 00	1,086 00
Quicksilver	29,330 00	151,200 00	123,624 00
Granite			375 00
Totals	$1,107,961 00	$1,010,769 00	$715,595 00

Substances	1900	1901	1902
Gold	$571,605 00	$684,683 00	$719,992 00
Silver	16,567 00	2,668 00	550 00
Quicksilver	105,982 00	58,668 00	10,251 00
Granite	4,535 00	5,500 00	
Copper		761 00	
Platinum			468 00
Totals	$698,689 00	$752,280 00	$731,261 00

Substances	1903	1904	1905
Gold	$607,728 00	$574,814 00	$690,844 00
Silver	2,085 00	135 00	3,044 00
Quicksilver	11,056 00	3,864 00	13,917 00
Granite	75 00		
Copper			
Platinum	200 00	275 00	
Totals	$621,244 00	$579,088 00	$708,255 00

Substances	1906	1907	1908
Gold	$560,843 00	$535,316 00	$602,944 00
Silver	2,981 00	2,399 00	4,269 00
Quicksilver	6,059 00	3,739 00	3,804 00
Granite			
Copper			
Platinum	130 00		
Totals	$570,013 00	$541,454 00	$611,017 00

Substances	1909	1910	1911
Gold	$520,046 00	$500,851 00	$612,149 00
Silver	2,302 00	1,960 00	6,777 00
Quicksilver	7,915 00	5,622 00	2,024 00
Granite			
Stone industry			
Copper			
Unapportioned, 1900-1909 (inc.)	111,307 00		
Totals	$641,570 00	$508,433 00	$620,950 00

Substances	1912	1913
Gold	$723,503 00	$431,862 00
Quicksilver	7,494 00	161 00
Silver	758 00	2,119 00
Stone industry	2,000 00	1,000 00
Totals	$733,755 00	$435,142 00

ELECTRICAL POWER PLANTS.

Humboldt Gas & Electric Company, with its generating plants about one mile northwest of Junction City, on the Trinity River, serves the territory on its line between this town and Eureka, Humboldt County.

Trinity Gold Mining & Reduction Company has a 700 horsepower plant on Coffee Creek and supplies power to the Alta Bert Dredging Company, and to its own property, the Headlight Mine, near Trinity Center.

Trinity Gold Dredge Company, with a 1500 horsepower plant, on Stewart's Fork, supplies power for operating its dredge at Lewiston.

The Bonanza King, generating plant, on the south fork of the Trinity River, supplies electricity for the mine and for the town of Trinity Center.

ASBESTOS.

Surface exposures of asbestos exist in the vicinity of Trinity Center, Weaverville, and Douglas City, but no work has been done on these deposits to determine their extent or commercial value. It is claimed that a promising deposit was uncovered some twenty-five years ago in constructing the Blythe ditch, in Sec. 28, T. 38 N., R. 6 W., but this ditch is now filled with débris and practically no indications of asbestos can be found.

Bibl.: Bull. No. 38, pp. 264, 360.

The *Trinity Asbestos Mining Company* is opening up a deposit of asbestos on a group of claims near the southern line of the county, and 25 miles from Castella.

CHROMITE.

Chromite is a black ore with a submetallic luster and in appearance resembles some of the iron ores. It occurs in small octahedral crystals and granular masses in serpentine rock, and consists, when pure, of 68% of chromium oxide and 32% of iron oxide; the commercial ores commonly run about 50% of chromium oxide and are generally sold on a 50% basis. It is a source of the chromium salts of commerce and is also used in the manufacture of chrome steel, in basic bricks, and in copper smelting. The quantity of this ore in California far exceeds the demand, the production value in 1912 being $11,260, from 1270 tons, reported from Shasta, Siskiyou and Fresno counties.

A fair grade of chromite is found in Trinity County on the north fork of the east fork of the Trinity River, in T. 38 N., R. 6 W., M. D. M. Another deposit is said to exist near Hay Fork, upon which some development work has been done.

Bibl.: Bull. No. 38, pp. 272, 363, 375.

COAL.

Hay Fork Valley Coal Field. Coal crops out in the bed of Hay Fork River in two points, one in Sec. 12, T. 31 N., R. 12 W., near the town of Hay Fork, and the other in Sec. 7, T. 31 N., R. 11 W., about two miles east of the town. The upper cropping near the town contains two veins of coal, each two feet thick, greatly weathered on the whole, yet in some places a tough black lignite is observed; dip 24° E. Sandstone forms the roof and footwall; deposit can be easily worked. This vein again outcrops in the hills north of the town.

Hyampom Valley Coal Field extends over a large area, the best indications being observed in Secs. 23, 24 and 25, T. 3 N., R. 6 E., H. M. These croppings, near the mouth of the Hay Fork of the Trinity River, are from 3 to 15 feet thick and dip at low angles eastward. Above the coal lies 8 inches of hard blue shale, 14 inches of sandstone, 22 feet of brown shale, and next gravel and soil to the surface. As no development work has been done, the commercial value of this deposit can not be stated.

Poison Camp Field. The croppings of coal are observed in Secs. 15 and 22, T. 2 S., R. 6 E., H. M. The vein is 3 feet thick and dips 24° E.; coal is very young, true lignite, tough and hard and resembles ebony wood; it has a dull brown-black color when split parallel to the fiber and glistening black when broken across the fiber. The coal is of good quality, as it runs high in carbon and low in ash, but the sand roof is so soft that mining would be difficult, unless it changes to a harder sandstone on driving under the hill. The analysis of this coal by Mathyas is as follows: Ash reddish-white color; no coking qualities; water 10.50; volatile matter 38.65; fixed carbon 24.15; ash 26.70.

Coal also outcrops in Sec. 6, T. 33 N., R. 12 W., near Big Bar; it is 2 feet thick, and similar in color and quality to the Hyampom Valley deposit; no development work performed.

Bibl.: Report X, p. 716; XII, pp. 62–63; XIII, p. 56.

COPPER.

The copper prospects of Trinity County are more widely scattered than those of any other county in northern California. They may be grouped in three belts, all of which are essentially areas of peridotite; New River, South Fork (territory lying to the east of the south fork of Trinity River, between Hyampom Valley and Rattlesnake Creek), and Trinity Center, near Carrville, and along the main branch of the Trinity River. Few of the prospects are of very great magnitude, and most of them are too inaccessible for present economical working. Some of the prospects contain ore of high grade and a few shipments have been made.

The expense of working these prespects is apparent when the ordinary freight rate of $15 per ton, from Weaverville or Trinity Center to Redding is considered, while the added cost from the prospects to these points is often large. In spite, therefore, of the natural advantages of timber and water power, copper mining in Trinity County has not yet progressed very far.

Bibl.: Report X, p. 716; XIII, p. 164; Bull. No. 50, pp. 140–146.

Bear Tooth, in the New River mining district; Quimby post office, eight claims on the east side of New River, at an elevation of 2600 feet in Trinity Reserve. Owners, Bear Tooth Mining Company, F. P. Burris, president; four parallel veins, from 1 to 4 feet wide; footwall in gabbro; hanging-wall is serpentine; 3 tunnels, upper 110 feet long, middle 300 feet, lower 125 feet in length; lower 400 feet below upper, has a length of 120 feet; ore consists of sulphide of iron and copper; and in upper part of the vein the ore is oxidized and shows free gold in panning; 8-ton Huntington mill. Idle at present.

Bibl.: Bull. No. 50, p. 144.

Black Palangus, in Sec. 36, T. 1 N., R. 6 E., H. M. Owners Hutchens Brothers. Open cuts; croppings are bold and 20 feet wide; some of the ore, sulphide of iron and copper, assays 17% copper. Idle.

Cinderella, in Sec. 9, T. 37 N., R. 7 W., M. D. M., in Trinity Center mining district. Owners, P. A. and E. A. Wagner, of Carrville. Comprises 2 claims; 300 feet of tunnels and 50-foot shaft; vein said to be 16 feet wide and to carry 10% copper; serpentine is the country rock; joins Copper Queen on the north.

Copper Button, in Sec. 36, T. 37 N., R. 7 W., in the Trinity mining district. Owners, Osborne & Baker. Comprises 4 claims; developed by short tunnels and open cuts; ore, which is high-grade, occurs in connection with dikes of quartz-porphyry in serpentine, and consists of oxides, carbonates and sulphides. Idle.

Bibl.: Bull. No. 50, p. 145.

Copper Queen, in Sec. 16, T. 37 N., R. 7 W., in the Trinity Center mining district. Leased to G. H. Fitch. Comprises 3 claims; short tunnels and shaft; ore occurs in serpentine and consists of oxides and carbonates of copper, with a little sulphide at the lower levels.

Bibl.: Bull. No. 50, pp. 145–146.

Copper Queen, in Secs. 10 and 11, T. 1 S., R. 6 E., H. M., 35 miles southeast of Bridgeville, Humboldt County. Owner, J. Hutchens. Comprises 6 claims; developed by a 40-foot tunnel and open cuts; ore consists of sulphide of iron and copper; strong gossan croppings. Idle.

Crown Point, in Sec. 18, T. 37 N., R. 7 W., in Trinity Center mining district. Owner, G. L. Carr, of Carrville. Ore body is wide and extensive; short tunnel and open cuts. Idle.

Bibl.: Bull. No. 50, p. 145.

Eureka, in Secs. 17 and 18, T. 37 N., R. 7 W., in the Trinity Center mining district. Owners, Dimmock & Hoefler, of Carrville. Comprises 2 claims; 50-foot tunnel; siliceous ore carrying a small percentage of copper sulphide. Idle.

Fortuna, in T. 1 S., R. 6 E., near the Copper Queen. Owner, Fortuna Mining Company, of Fortuna, Cal., C. Sweet, president. Holdings consist of 19 claims, about 30 miles from Bridgeville. Only slightly developed with open cuts and short tunnels. Conspicuous gossan croppings on claims. Ore is a sulphide of iron and copper. Idle.

Granite, on Quimby Creek, 6 miles above its mouth, in Trinity Reserve. Owners, F. C. Patton et al., of Weaverville; 7 claims; ore occurs in serpentine and slate; some of the ore carries 25% copper, with some gold; only little development work; facilities for mining are good.

Bibl.: Bull. No. 50, p. 143.

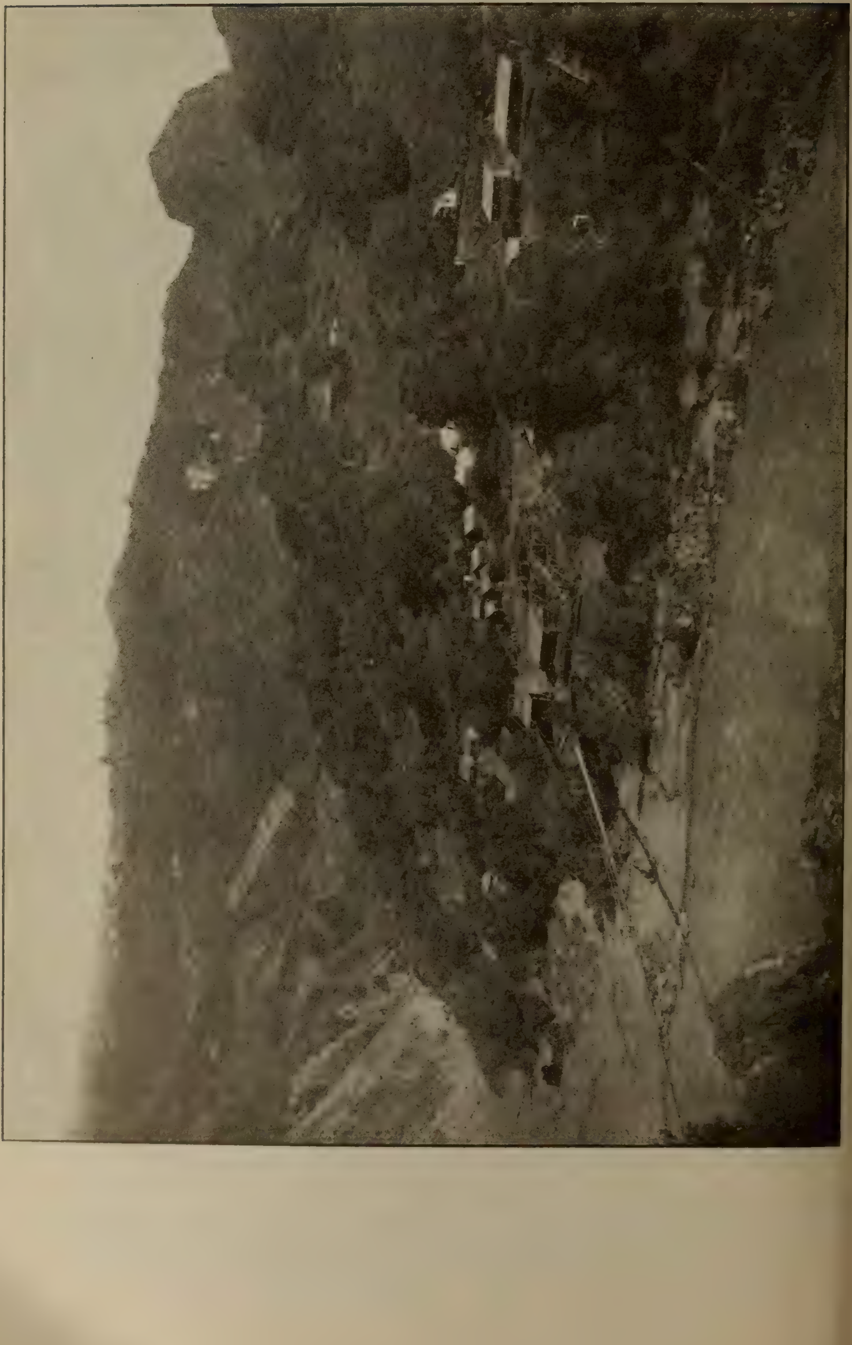


Photo No. 1. Island Mountain Consolidated; croppings and improvements.

Island Mountain Consolidated, in Secs. 9, 10 and 15, T. 5 S., R. 6 E., in the Horseshoe mining district, 90 miles north of Ukiah. Owners, Leach and Wilcox, of Oakland, Cal. Comprises 275 acres along the Eel River; elevation 750 feet; located in 1892; ore, iron sulphides, carrying copper, iron and zinc, occur in lenses between sandstone walls; strike northwest and southeast; greatest depth 145 feet; workings consist of 400-foot tunnel and 2000 feet of drifts; claim 300,000 tons of ore in sight; croppings in places 180 feet wide, and can be traced for 500 feet; equipment consists of dwellings and shops; only little work done since 1895; about $20,000 has been spent in development work. The Northwestern Pacific Railroad is being built on a portion of this property and ore will be shipped to a smelter as soon as the road is completed. Largest copper mine in Trinity County. (See photo No. 1.)

Bibl.: Bull. No. 50, p. 148.

Jackson & Carter, in Sec. 29, T. 31 N., R. 10 W., 8 miles southeast of Hay Fork. Owners, Carter & Jackson. Comprises 4 claims; 40-foot shaft; lode 10 feet wide; can be traced only a short distance; ore consists of sulphide of iron and copper, said to assay 10% copper. Idle.

Lone Pine, in Sec. 19, T. 1 N., R. 8 E., H. M., near the mouth of Rattlesnake Creek. Owners, D. and M. Murphy. Holdings consist of two claims. Only slightly developed. Ore occurs in diorite, and is a copper sulphide. Idle.

Bibl.: Bull. No. 50, p. 142.

Murphy, in Sec. 36, T. 1 N., R. 7 E., H. M., in the Hyampom Valley. Owners, M. and D. Murphy. Three shafts and one tunnel over 400 feet long. Ore occurs in serpentine, in veins of white feldspathic rock, carrying high grade oxides, carbonates and sulphide. Idle.

Bibl.: Bull. No. 50, p. 142.

Nonpareil, in Sec. 5, T. 36 N., R. 12 W., 3 miles southeast of Couer, in the Trinity Reserve. Owner, C. S. McAtes, of Redding; short tunnel on the property; lode varies from 1 to 14 feet in width, but can not be traced continuously for any distance; gossan croppings in places for a mile along its strike; ore said to average 8% copper. Idle.

Bibl.: Report XIII, p. 64; Bull. No. 50, p. 143.

Quimby, on Quimby Creek, in the Trinity Reserve, owned by the Quimby Mining Company; six claims; vein 4 feet wide; sulphide, iron and copper, is oxidized near the surface and was milled; two tunnels, 100 and 400 feet in length; 300 feet of drifts. Idle.

Bibl.: Bull. No. 50, p. 144.

Vine Oak, consists of two claims, in Secs. 2 and 35, T. 1 N. and 1 S., R. 7 E., owned by I. P. Collins, Hay Fork. Ore consists of copper sulphide, carrying some gold, and occurs in diorite. Slightly developed by means of short tunnels.

Bibl.: Bull. No. 50, p. 143.

GOLD.

Native gold is the principal valuable mineral of the veins, as the sulphides form only a small part of the total volume. The fissure veins are usually associated with dikes of soda-granite porphyry. The veins are persistent both in dip and strike, and below a shallow zone of surface enrichment show no marked change in character with depth. The pocket deposits are usually found along faulted contacts of the slate and meta-andesite. The vein filling consists of quartz and calcite, with small amounts of galena, sphalerite and arsenopyrite, as well as free gold.

MINING DISTRICTS.

Canyon Creek Mining District, famous in the early days for its rich placers, both creek and bench, is now being developed for quartz. This creek heads in the Salmon Range in T. 39 N., R. 10 W., and flows south and empties into the Trinity River at Junction City in Sec. 12, T. 33 N., R. 10 W. The formation in this region consists of hornblende schist and granite-porphyry. The first quartz location was made in 1889, on the Chloride, now one of the claims of the Globe group.

Bibl.: Report X, pp. 710–711; Bull. No. 540, pp. 76–78, U. S. G. S.

Coffee Creek, one of the main tributaries of the Trinity, heading in the Granite Mountains of the Salmon River and flowing easterly through townships 37 and 38, has been worked for years for placer gold. The topography of the section between the headwaters of this creek and the Salmon River, in Siskiyou County, indicates that the river formerly had an outlet through Coffee Creek channel to the valley of the Trinity. Quartz mining has been diligently pursued along Coffee Creek and its tributaries, in recent years, and several high-grade producers developed.

Bibl.: Report X, p. 697.

Deadwood Mining District, is situated on the western slope of the Trinity range, in T. 33 N., R. 8 W., and is a continuation of the French Gulch mineral belt. Brown Bear is the famous quartz mine in this district.

Bibl.: Report X, pp. 713–714; U. S. G. S. Bull. No. 540, pp. 69–71.

In the *East Fork Mining District,* the formation is mainly granitic gneiss and mica schists, overlying the true granite, and the quartz veins seem to be incased in the strata between the primary and metamorphic rocks. In portions of this district the stratified rocks are much contorted, giving the veins very uncertain courses or dips, being especially noticeable in the Enterprise mine, where the vein has been disturbed and broken and is resting on the formation as a blanket ledge. The mica of the gneiss and schist is of a silvery white (muscovite), in places the mica entering the quartz, forming a quartz schist, and in such cases the vein yielded to the granitic rocks and pinched out. The Enterprise is the most active quartz mine in this district.

Bibl.: Report X, p. 710.

The Minersville District includes the country along the Trinity River between Trinity Center and Papoose Creek.

The contact between meta-andesite and slate has furnished rich pocket deposits, especially in the vicinity of the old town of Minersville. Much gold has also been supplied to the placers of this neighborhood from the same source.

The Five Pines is the most active quartz mine in this district at the present time.

Bibl.: U. S. G. S. Bull. No. 540, pp. 73–76.

Stewart's Fork, heads in the Salmon Mountains in T. 37 N., R. 10 W., and flows southeasterly, emptying into the Trinity River in T. 34 N., R. 9 W. On Deer Creek, one of the tributaries to Stewart's Fork, several quartz locations have been made, but only a small amount of development work has been done. This region presents a promising field for the prospector. The formation consists of granite, with slate, and also large belts of dolomitic limestone in contact with the serpentine from the northeast; the quartz is white, containing sulphurets of arsenical iron, galena, copper and zinc; but little free gold is detected by panning.

Bibl.: Report X, p. 713.

Trinity Center Mining District, noted for the richness of its auriferous gravels, was settled in 1851. The deposits of gravel are in the form of benches caused by old river channels, and are about 1 mile in width, varying in depth from 20 feet on the lower to 80 feet on the upper benches, being a section of the flow of gravel from Coffee Creek to the Weaver Basin. Dredging operations are being successfully pursued near the town of Trinity Center. A large area of placer ground along the Trinity River between Trinity Center and Carrville, affords an excellent dredging field.

Bibl.: Report X, p. 698; Bull. No. 540, p. 19, U. S. G. S.

GOLD MINES—QUARTZ.

Alaska, in Sec. 15, T. 35 N., R. 11 W., in the East Fork mining district, 10 miles northeast of North Fork. Owners, W. F. Jenkins et al. Comprises 40 acres, at an elevation of 3100 feet; ore shoot is 340 feet long and 2½ feet wide between slate walls; 560-foot tunnel and 1500 feet of drifts; 1 stope (100 feet by 4 feet by 80 feet); old 13-foot arrastra used for milling purposes; ore is free milling and rich; said to have produced $600,000; several years since property has been worked; no ore in sight.

Bibl.: Report XIII, p. 437.

Amy Balch, in Sec. 13, T. 33 N., R. 8 W., in the Deadwood mining district, 1 mile south of Deadwood. Owner, M. G. Carter. Comprises 60 acres, at an elevation of 3400 feet; ore shoot is 110 feet long and 16 inches wide, free milling and high grade, between walls of quartz-porphyry; strike of vein S. 40° E.; dip 40° N.; greatest depth 140 feet; workings consist of 540-foot tunnel, 400 feet of drifts, 90-foot raise and 1 stope 50 feet by 3 feet by 90 feet; equipment consists of cars, dwellings and 9-foot arrastra run by waterpower from Thorne Gulch, through a ditch 1 mile long; 2 men are employed doing prospect work; said to have produced $60,000.

Bibl.: Report XIII, p. 437.

Armstrong, in Sec. 6, T. 37 N., R. 12 W., in the New River mining district, ¾ mile north of Denny, in the Trinity Reserve. Owner, J. E. Miller. Comprises 40 acres; located in 1890; small vein in quartz-porphyry; 210-foot tunnel; little high-grade taken out on the surface. Idle.

Bibl.: Report XIII, p. 437.

Big Chief, in Sec. 16, T. 8 N., R. 8 E., in the New River mining district, 2 miles south of Denny in the Trinity Forest Reserve. Owners, Ladd Brothers. Comprises 40 acres; located in 1908; elevation 3800 feet; extent of ore shoot not determined, but exposed continuously in tunnel, 100 feet long; walls are schist; width of vein 14 inches; ore runs from $15 to $60 per ton; good prospect; one man working.

Bigelow, in Secs. 15 and 16, T. 34 N., R. 10 W., in the Canyon City mining district, 1½ miles southeast of Dedrick, in the Trinity Forest Reserve. Owner, J. E. Henry. Comprises 20 acres; short ore shoot in hornblende-schist and granodiorite; 70-foot shaft; little high-grade extracted; endeavoring to find ore shoot beyond a fault; 2 men employed.

Blue Jacket, in Secs. 17 and 18, T. 37 N., R. 7 W., in the Trinity Center mining district, 1½ miles northwest of Carrville, in the Shasta

Reserve. Owner, Adams Exploration Company, an eastern corporation. G. L. Carr, superintendent. Comprises 450 acres; ore shoot 200 feet long and 5 feet wide; strike N. 40° E.; dip 40° SE.; footwall is serpentine and hanging-wall is quartz-porphyry; maximum depth, 320 feet. Workings: Tunnel 820 feet long, drifts, raises and stopes. Equipment: Cars, dwellings, blower, 5-stamp mill, driven by water-power from Coffee Creek through ¾ mile of flume; 3 men employed; some ore in sight; producer at one time; ore free milling, but low-grade, with rich spots occasionally.

Bibl.: Report XIII, p. 439.

Blue Jay, in Sec. 13, T. 37 N., R. 8 W., in the Trinity Center mining district, 2½ miles west of Carrville, in the Shasta Forest Reserve. Owner, M. McIllwain. Comprises 40 acres; located in 1886; 2 veins in quartz-porphyry; short ore shoot 16 inches wide; tunnels 500 feet long and 200 feet of drifts; little high grade extracted. Idle.

Blue Jay, formerly known as Knob, in T. 33 N., R. 8 W., in the Lewiston mining district, 4¾ miles northeast of Lewiston. Owners, Paulson & Gifford. Comprises 40 acres on Eastman Gulch; ore shoot 80 feet long and 1 foot wide; high-grade stringers running from vein; 480-foot tunnel, 200 feet of drifts, 100-foot raise to surface from tunnel and 1 stope 40 feet by 3 feet by 100 feet; equipment consists of cars, blacksmith shop and dwelling; 2 men employed; ore reduced in the Venicia mill.

Bonanza, in Sec. 9, T. 35 N., R. 11 W., in the East Fork mining district, 13 miles northeast of North Fork by trail, in Trinity Reserve. Owner J. L. Johnston. Comprises 40 acres at an elevation of 3000 feet; 320-foot tunnel and 500 feet of drifts and raises; ore free milling and shoot 300 feet long and 4 feet wide; little rich ore extracted. Idle at present.

Bonanza, in Sec. 29, T. 35 N., R. 8 W., in the Minersville mining district, ¾ mile north of Minersville, in the Trinity Reserve. Owner J. H. Tourtellate. Comprises 40 acres, located in 1890; elevation 2700 feet; short ore shoot, free milling and high grade, in slate; 130-foot incline shaft, 200-foot drift and 60-foot tunnel; $15,000 extracted from pockets. Idle at present.

Bibl.: Report XIII, p. 439.

Brown Bear, in Secs. 11 and 12, T. 33 N., R. 8 W., in the Deadwood mining district, in the old town of Deadwood, is the most famous quartz mine in Trinity County, having been a producer since 1875. It is owned by the Brown Bear Mining Company of Redding. Thos. McDonald, president; B. McDonald, superintendent. Comprises 586 acres of quartz locations of which 200 are patented and 671 acres of timber land; number of veins, two—Monte Cristo and Last Chance; free milling; ore shoot 600 feet long and 2 feet wide; strike east and west; dip 60° E.; walls are slate; workings consist of seven tunnels from 100 to 2400 feet in length, the main workings being on the Last Chance and Ned Roberts claims; greatest depth on vein, 750 feet; over 3000 feet of drifts and several stopes (200 feet by 4 feet by 200 feet); equipment: cars, dwellings, assay office and 10-stamp mill and two Wilfley tables, driven by waterpower from Deadwood Creek through a 3-mile ditch; four men employed at present, one on top and three in the mine; five men are leasing from the company; a production record of $8,000,000 is claimed.

Bibl.: Report VIII, p. 639; X, p. 713; XII, p. 308; XIII, pp. 440–441. U. S. G. S. Bull. No. 540, pp. 70–71.

Buck, in Sec. 14, T. 32 N., R. 9 W., in the Indian Creek mining district, 4½ miles southeast of Douglas City. Owner, J. W. Phillips. Comprises 40 acres; located in 1890; short ore shoot, 6 inches wide, in slate; 210-foot tunnel, 200 feet of drifts and a stope, 40 feet by 3 feet by 50 feet; some high grade near the surface; ore somewhat rebellious as depth is attained; old 9-foot arrastra. Idle.

Bully Choop, in Secs. 5, 8, 9 and 4, T. 31 N., R. 8 W., in the Indian Creek mining district, 16 miles southeast of Douglas City. Owner, Bully Choop Gold Mining and Power Company of Atlanta, Georgia, J. F. Beck, president. Comprises 588 acres, of which 198 are patented. Length of pay shoot, 230 feet; width, 6 feet; strike east and west; dip 40° S.; walls quartz-porphyry; greatest depth, 320 feet; workings, several tunnels, longest being 1700 feet, several thousand feet of drifts, raises and stopes; ore, free milling, but becomes somewhat base as depth is attained; water for power obtained from north and south forks of Indian Creek, through a 3-mile ditch. Equipment: cars, dwellings, sawmill, electrical plant, telephone line (15 miles long), and 30-stamp mill driven by water and electrical power; has been a producer; some ore reserve in the mine. Idle at present.

Bibl.: Report VIII, pp. 640-641; XII, p. 308; XIII, p. 441.

Carrie, in Sec. 5, T. 37 N., R. 12 W., in the New River mining district, 3 miles northeast of Denny, in the Trinity Reserve. Owner, G. Ferney. Comprises 20 acres at an elevation of 4600 feet; small vein, in diabase; 380 feet of tunnels and 300 feet of drifts; ore high grade; some rich pockets found; produced $16,000. Worked by lessee.

Chapman, in Sec. 33, T. 38 N., R. 8 W., in the Trinity Center mining district, 7 miles northwest of Carrville, in the Shasta Forest Reserve. Owner, W. Chapman. Comprises 60 acres, at an elevation of 3700 feet; ore shoot is 80 feet long and 2 feet wide, in serpentine;

220-foot tunnel, 130-foot drift and 40-foot winze; 5½-foot Huntington mill, run by both steam and waterpower; 20 h.p. boilers; two men employed; some high grade ore; said to have produced $20,000.

Cleveland, in Secs. 4, 9 and 16, T. 31 N., R. 8 W., in the Indian Creek mining district, 15 miles southeast of Douglas City. Owner, Cleveland Consolidated Mining Company, of Red Bluff, Cal., R. G. Hart, president. Comprises 100 acres, patented, at an elevation of 5800 feet; 12-mile trail to mine; 300-foot ore shoot, 7 feet wide; low grade and base as depth is attained; greatest depth, 220 feet; 460-foot tunnel and 300 feet of drifts. Idle. Said to have a small production record.

Craig, formerly known as the *Mason and Thayer*, in Secs. 4, 5, 32 and 33, T. 34 and 35 N., R. 10 W., in the Canyon Creek mining district, 3 miles northeast of Dedrick, in Trinity Reserve. Owner, Craig Mining Company, F. M. Craig, president and manager; H. C. Stofer, superintendent. Comprises 100 acres, acquired by this company in 1911; elevation 4200 feet; length of ore shoot, 400 feet, width 4 feet; length driven on vein, 830 feet; depth on vein, 420 feet; three tunnels, on vein, from 100 to 830 feet in length, with drifts and crosscuts, comprise several hundred feet of development work; walls are hornblende schist; strike of vein northwest and southeast; dip 60° N.; equipment consists of cars, dwellings and assay office; number of men employed—top, four; mine, eight; total twelve; considerable tonnage of ore blocked out, all free milling; one of the best properties in the district, ranking next to the Globe; excavation made for a 20-stamp mill.

Bibl.: U. S. G. S. Bull. No. 540, p. 78.

Dixie Queen, in Secs. 14 and 23, T. 32 N., R. 9 W., in the Indian Creek mining district, 5 miles southeast of Douglas City. Owners, Morris Brothers. Comprises 20 acres, at 2700-foot elevation; small vein, high grade and free milling, in slate; 150-foot tunnel and 100-foot drift; two men employed; about $10,000 taken out in pockets.

Enterprise, in Secs. 4 and 5, T. 35 N., R. 11 W., in the East Fork mining district, 7½ miles north of North Fork, in the Trinity Forest Reserve. Owner, Enterprise Gold Mining Company, of Boston, Mass., Geo. S. Fenwick, secretary; comprises 160 acres, the first claim, Lone Jack, being located in 1882, and mine has been operated more or less continuously ever since; number of veins, 1; ore free milling and of good grade; length of pay shoots—three shoots—900, 300 and 300 feet, and average width of 14 inches; strike northeast and southwest; dip from 10° to 45° NW.; diorite walls; several tunnels, one being 1400 feet long; 3000 feet of drifts and crosscuts; three stopes, 500 feet by 5 feet by 50 feet, 900 feet by 5 feet by 200 feet, and 300 feet by 5 feet by 240 feet; greatest vertical depth, 500 feet; equipment: cars, 5 machine drills, Compressor plant, Cameron pump, small electric plant, sawmill, assay office, dwellings and small underground winch; 10-stamp mill, run by waterpower, 1 Frue and 1 Woodbury table; number of men employed, mine 10, mill 2, total 12; production to date, over $350,000; cost over $7 per ton for operating; mine leased to Skinner & Day, who milled 1300 tons and saved $20,000 on the plates; considerable ore blocked out; some of the ore carries tellurium.

Bibl.: Report VIII, p. 643; X, p. 710; XI, p. 482; XIII, p. 446.

Eureka, in Sec. 33, T. 35 N., R. 10 W., in the Canyon Creek mining district, 3 miles south of Dedrick. Owner, Maple Creek Mining Company, of Weaverville; L. E. Smith, president; P. Flathery, superintendent; comprises 120 acres; 200-foot ore shoot, 3 feet wide, between schist and porphyry walls; 400-foot tunnel and stope (60 feet by 4 feet by 80 feet) on Gray Eagle Claim; ore worked in arrastra at one time; 2 men employed, doing assessment work.

Excelsior, in Secs. 5 and 8, T. 37 N., R. 12 W., in the New River mining district, 2½ miles northeast of Denny, in the Trinity Forest Reserve. Owners, Harris & Colegrave; comprises 80 acres, at an elevation of 4800 feet; ore shoot 300 feet long and 18 inches wide; between granite walls, maximum depth 315 feet; strike northwest and southeast; dip N. 50° E.; two tunnels, one on vein having a length of 700 feet and the crosscut 240 feet; 1600 feet of drifts, several raises and stope (100 feet by 3 feet by 90 feet); old 2-stamp mill; said to have produced $160,000; only high grade ore worked. Idle.

Bibl.: Report XIII, p. 446.

Fairview, in Sec. 3, T. 34 N., R. 8 W., in the Minersville mining district, 1½ miles southeast of Minersville, in the Trinity Forest Reserve. Owner, Fairview Mining Company, of San Francisco; Charles Allenberg, president; H. Waldo, superintendent; comprises 320 acres, of which 160 acres are patented; elevation 3000 feet; strong fissure vein, in slate; strike northeast and southwest; dip 40° S.; ore shoot is 500 feet long and 3 feet wide; greatest depth on vein, 450 feet; workings consist of 4 tunnels from 150 to 1500 feet in length, all connected with a raise and 2 stopes (100 feet by 4 feet by 140 feet); equipment consists of cars, 1000 feet of automatic tramway, assay office, dwellings and 40-stamp mill, driven by waterpower; water obtained from Stewart Fork, through a ditch five miles long; production $500,000, from 1900 to 1907, and during this time 100 men were employed; since 1907 it has been worked by lessees.

Bibl.: U. S. Geol. Surv. Bull. No. 540, pp. 75–76.

Five Pines, in Secs. 20 and 29, T. 35 N., R. 8 W., in the Minersville mining district, two miles northwest of Minersville, in the Trinity Reserve; owner, Five Pines Mining Company, of Minersville, H. J. Van Ness, president; L. Van Ness, manager; located in 1896; length of ore shoot not determined; ore occurs in meta-andesite and slate, and is free milling and high grade; workings consist of incline shaft, 225 feet deep, one level with 90-foot drift and 1 stope (100 feet by 3 feet by 60 feet); equipment, small hoist, cage, dwelling and 2-stamp mill; waterpower used; 4 men employed; production to date, $275,000; coarse gold and 80 per cent of the total value recovered in hand mortar and pan; rich pockets occur along the water courses; in a vertical depth of 44 feet, $45,000 was extracted from one pocket; other pockets run from $10,000 to $15,000; surface ore is honeycombed and stained with manganese oxide; best producer in this district.

Bibl.: U. S. Geol. Surv. Bull. No. 540, pp. 73–74.

Forget-Me-Not, in Secs. 8 and 9, T. 37 N., R. 7 W., in the Trinity Center mining district, 1½ miles northeast of Carrville, in the Shasta Reserve. Owner, Carr Estate; comprises 34 acres, at an elevation of 3500 feet; ore shoot 100 feet long and 2 feet wide, free milling; footwall is diorite and hanging-wall quartz-porphyry; strike N. 40° E., dip 20° S.; workings: tunnel 1000 feet long, 400 feet of drifts from old shaft (100 feet deep), two stopes 40 feet by 3 feet by 50 feet; equipment: cars, dwelling, 50-h.p. boiler, 5-stamp mill driven by steam and water power; some high grade ore worked in an arrastra years ago; producer at one time; bonded to Adams Exploration Company. Idle at present.

Bibl.: Report XIII, p. 446.

Fountain Head, in Sec. 4, T. 34 N., R. 11 W., in the North Fork mining district, 5 miles north of North Fork. Owner, R. Ellson; comprises 40 acres, reached by trail from North Fork; short ore shoot in slate; ore free milling and high grade; 460-foot tunnel, drifts and stope; old 5-stamp mill, steam driven (idle); said to have produced over $50,000; ore reserve worked out; idle at present.

Bibl.: Report XIII, p. 447.

Four Point, in Sec. 32, T. 35 N., R. 10 W., in the Canyon Creek mining district, 3 miles north of Dedrick, in the Trinity Reserve. Owner, H. C. Stofer et al.; comprises 40 acres, located in 1894; 150-foot tunnel, all in ore, 15 inches wide; hornblende schist and quartz-porphyry walls; building a 12-foot arrastra to be operated by water from Chloride Gulch; three owners working.

Globe, in Secs. 15, 16 and 21, T. 35 N., R. 10 W., in the Canyon Creek mining district, 4 miles north of Dedrick, in the Trinity Reserve.

Owner, Globe Consolidated Mining Company, a Canadian corporation; J. B. Goodyear, president; T. M. Craig, secretary; W. Macgreagor, superintendent; comprises 200 acres, acquired in 1910, and includes the old Bailey, Chloride and Globe groups; elevation, 6100 feet; length of ore shoot, 600 feet; width 6 feet; strike northeast and southwest; dip 60° E.; walls, hornblende schist; number of veins, 4: Chloride, Bailey, Globe and Boyd; free milling ore; length driven on vein, 1700 feet; greatest depth on vein, 620 feet; 6 tunnels in all, from 250 to 1700 feet long; several thousand feet of tunnels, crosscuts, drifts and stopes; one stope is 200 feet by 6 feet by 40 feet (filled with waste); large tonnage blocked out in mine; mine equipment: cars, compressor plant, electrical plant, sawmill, dwellings, assay office, executive offices;

Photo No. 2. Globe Mine; 20-stamp mill.

reduction equipment: 20-stamp mill just completed (direct cyaniding), 100-ton cyanide plant, tubemill, 5600-foot automatic-gravity tramway from mine to the mill, 500-ton bins; water power used from Canyon Creek; plant complete cost over $300,000; number men employed: top 85, mine 25, total 110; property said to have produced $700,000 before acquired by this company. (See photos Nos. 2 and 3.)

Bibl.: Reports X, p. 711; XI, p. 483; XII, pp. 309, 310; XIII, p. 447; U. S. Geol. Surv. Bull. No. 540, pp. 76–78.

Photo No. 3. Globe Mine; section of flume.

Golden Chest, in Sec. 9, T. 35 N., R. 11 W., in the East Fork mining district, 13 miles northeast of North Fork, by trail, in Trinity Reserve. Owners, Boyce et al.; comprises 40 acres, at an elevation of 3300 feet; ore shoot, 300 feet long and 2 feet wide; fissure vein, with slate walls; strike east and west; dip 40° S.; 490-foot tunnel, several hundred feet of drifts and stopes; only worked to a shallow depth, 150 feet; free milling ore of good grade; equipment: cars, dwellings, 5-stamp mill (old 750-pound stamps), and 4 concentrators; idle for several years; some rich ore worked at one time and property said to have produced $200,000.

Bibl.: Reports X, p. 711; XIII, p. 447.

Golden Jubilee, in Sec. 10, T. 37 N., R. 8 W., in the Trinity Center mining district, 8 miles southwest of Carrville, in the Shasta Reserve. Owner, Coffee Creek Mining and Milling Company, of Redding; R. M. Saeltzer, president; J. Boedecker, superintendent; comprises 150 acres, patented; elevation, 3200 feet; length of ore shoot, 140 feet; width, ½ feet; strike northeast and southwest; dip 40° E.; footwall slate, and hanging-wall diorite; workings consist of tunnel 750 feet long, several hundred feet of drifts, raises and stopes; equipment: cars, dwellings, blower and pipe, assay office, and 10-stamp mill driven by steam and water power (idle); 50-h.p. boiler; 5 men employed in mine; some high grade ore extracted; paid some dividends; said to have produced $250,000.

Hardtack, in Sec. 6, T. 37 N., R. 12 W., in the New River mining district, 1 mile north of Denny, in the Trinity Reserve. Owner, T. J. Ladd; comprises 40 acres, located in 1889; elevation 4700 feet; ore shoot 80 feet long and 18 inches wide, in quartz-porphyry; 320-foot tunnel; little high grade ore extracted; only do assessment work.

Bibl.: Report XIII, p. 448.

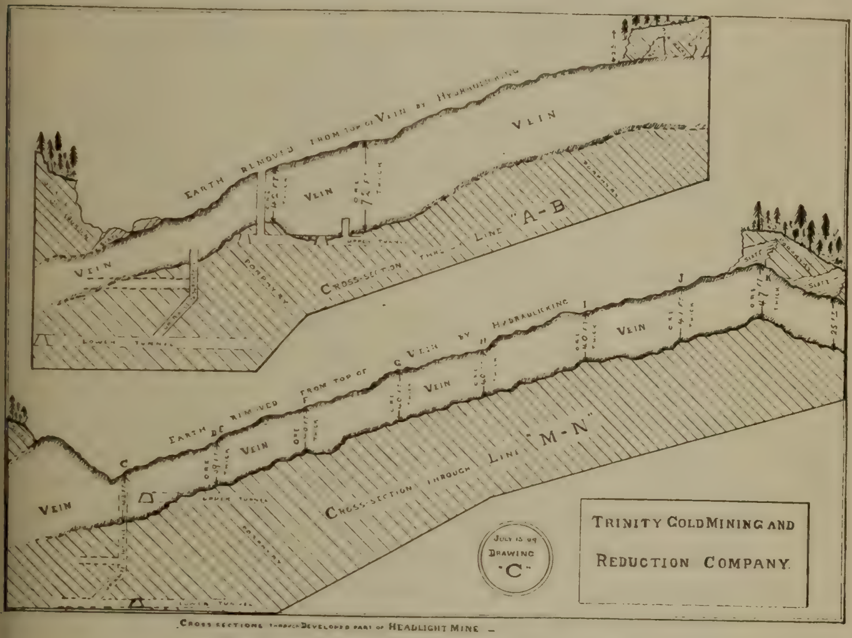
Hard Times, in Sec. 6, T. 37 N., R. 12 W., in the New River mining district, 3 miles north of Denny, in the Trinity Reserve. Owner, E. C. Miller; comprises 60 acres, at an elevation of 4400 feet; ore shoot 100 feet long and 2 feet wide in diabase; 210-foot tunnel and 400 feet of drifts; some rich ore extracted; said to have produced $20,000; worked at times by lessees. Idle.

Bibl.: Report XIII, p. 448.

Hay Fork Mining and Milling Company, in T. 31 N., R. 11 W., about 3½ miles southeast of Hay Fork. Owner, Dr. Mueller et al., of Redding; comprises 100 acres, at an elevation of 3400 feet; 2 veins in schist; short ore shoot; 3 tunnels, from 60 to 230 feet in length; little high grade extracted. Idle.

Headlight, in Secs. 20 and 21, T. 37 N., R. 7 W., 1½ miles southeast of Carrville, has the largest reduction plant in Trinity County. It is owned by the Trinity Gold Mining and Reduction Company, of New York; H. W. Miller, president; J. H. Lee, secretary; D. W. Shanks, general manager; D. Goodale, superintendent; comprises 423 acres, of which 320 acres are patented; in the Shasta Reserve; elevation, 3500 feet; ore shoot, 600 feet long and 35 feet wide, with several deposits, also; strike east and west; dip 22° N.; footwall, andesite, and hanging-wall, slate; maximum depth, 200 feet; workings consist of several tunnels, one being 350 feet long, open cuts, raises and drifts, comprising several thousand feet of development work; ore free near the surface, but base with depth, containing iron and copper sulphides (see map-drawing "C"); company claims 300,000 tons at value of $6 per ton, as an ore reserve; mine equipment: cars, tools, 2 giants and pipe, shops, 700 h.p. electrical plant, with 2 miles of power line, assay office, sawmill, and dwellings; reduction equipment: 40-stamp Hendy mill, electrically driven, and 250-ton cyanide plant, constructed in 1910, and idle at present, as values can not be saved and experiments have been made so far without success; 8 men are employed; production to date, $500,000, in two years; ore runs from $6 to $8 per ton; total operating cost per ton, from $2.10 to $2.40; electric plant is on Coffee Creek; one of the best equipped quartz mines in the county.

Bibl.: Report XIII, p. 449.


Earth removed from top of Vein by Hydraulicking
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Cross-section thru Line "A-B"
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Earth removed from top of Vein by Hydraulicking
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Cross-section through Line "M-N"
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Drawing
"C"
Trinity Gold Mining and
Reduction Company
Cross sections through Developed part of Headlight Mine

Headlight Mine, Trinity County, California.

Hunter, in the New River mining district, 40 miles by trail from Helena, in Trinity Reserve. Owner, J. P. Hennessy; comprises 120 acres, located in 1888; elevation 4500 feet; extent of ore shoot not determined; can be traced for 400 feet on the surface; workings consist of 500-foot crosscut tunnel and 600 feet of drifts, 1 stope and 60 and 80 foot raises; equipment: cars, dwellings, 10-stamp mill (850 lb. stamps), one Frue vanner run by steam power; vein is spotted, with high grade found at times; idle since June, 1912; 9 men employed when in operation; small producer.

Bibl.: Report XIII, p. 450.

Isabel, in Sec. 32, T. 35 N., R. 10 W., in the Canyon Creek mining district, 2½ miles north of Dedrick, in the Trinity Reserve. Owner, T. E. Martin; comprises 60 acres; short ore shoot in granite; 210 and 90 foot tunnels; said to have produced some high grade ore. Idle.

Jacoby, T. 33 N., R. 9 W., about 6 miles northeast of Lewiston, on Eastman Gulch. Owners, Goodyear & Richards; comprises 80 acres, located years ago; ore shoot is 100 feet long and 14 inches wide, free milling and good grade; footwall is slate and hanging-wall quartz-porphyry; strike northwest and southeast; dip 15° S.; workings consist of 550-foot tunnel, 400 feet of drifts, and 1 stope, 60 feet by 3 feet by 90 feet; greatest depth on vein is 200 feet; equipment consists of cars, dwelling and 2-stamp Hendy mill (1000-lb. stamps), driven by waterpower from Eastman Gulch through a ditch ¾ mile long; best ore in pockets and worked for high grade; a production of $50,000 is claimed; leased to Paulson Brothers; idle at present.

Jerusalem, in Sec. 9, T. 31 N., R. 8 W., in the Indian Creek mining district, 10 miles west of Ono, by trail. Owner J. T. Lockhard; comprises 80 acres; ore shoot is 200 feet long and 2 feet wide; 560-foot tunnel and 300 feet of drifts; some rich ore extracted at one time; idle for several years.

Bibl.: Report XIII, p. 450.

Lapman, in Sec. 12, T. 33 N., R. 8 W., in the Deadwood mining district, ¾ mile north of Deadwood. Owner, Calumet-Michigan Mining Company, of Detroit; comprises 60 acres, on Thorne Gulch; ore shoot is 100 feet long and 10 inches wide; slate footwall, and quartz-prophyry hanging-wall; 3 tunnels on vein from 50 to 450 feet long and 300 feet of drifts; little high grade ore extracted; being worked by George Bacon, on a lease, who is prospecting for "high grade."

Last Chance, in T. 33 N., R. 8 W., in the Lewiston mining district, 5 miles northeast of Lewiston. Owners, Newland & Dean. Comprises 60 acres on Eastman Gulch; small vein, high grade, in slate; 220-foot tunnel, 250 feet of drifts, and 1 stope; equipment consists of cars and dwellings; worked for "pockets"; claim a production of $20,000. Idle at present.

Laurel, in Sec. 14, T. 32 N., R. 9 W., in the Indian Creek mining district, 4 miles southeast of Douglas City. Owner, C. E. Connor. Comprises 20 acres; located in 1893; small vein; worked for pockets; rich bunch taken out near surface; 180-foot tunnel. Idle.

Layman, formerly known as *Horseshoe,* in Sec. 33, T. 32 N., R. 11 W., in the Hay Fork mining district, 2 miles north of Hay Fork. Owner, Estate of J. B. Layman. Comprises 120 acres, at an elevation of 2900 feet; 2 parallel veins, about 400 feet apart; short ore shoot in schist; 3 tunnels, 280, 85 and 60 feet in length; little high grade found. Idle.

Maple, in Sec. 1, T. 34 N., R. 11 W., 4 miles south of Dedrick, in the Canyon Creek mining district, in Trinity Reserve. Owner, T. E. Reed. Comprises 20 acres; located in 1894; 100-foot ore shoot, 12 inches wide, between slate and granodiorite walls; 230-foot tunnel and 1 stope (30 feet by 3 feet by 40 feet); 12-foot arrastra, run by

15-foot overshot wheel, water being obtained from Canyon Creek through 1 mile ditch; worked as a pocket mine and about $10,000 produced. Owner does only assessment work.

Bibl.: Report XII, p. 312; XIII, p. 454.

Modoc, in Sec. 31, T. 9 N., R. 7 E., in the New River mining district, ½ mile north of Coeur, in the Trinity Reserve. Owner, G. W. Healey. Comprises 20 acres; located in 1889; ore shoot, 130 feet long and 14 inches wide, free milling and good grade; walls are diabase foot and granitic-porphyry hanging; strike is N. 30° W.; dip 50° S.; workings, 480 and 160-foot tunnels, 600 feet of drifts and stope (80 feet by 3 feet by 60 feet); equipment: dwelling and old 1-stamp mill (650-pound stamp), driven by waterpower from Eagle Creek through 1-mile ditch; some high grade ore worked, all free milling; said to have produced $20,000. Idle.

Mountain Boomer is the best producer in the New River mining district, but is very expensive to operate as supplies must be packed over a trail either from Hawkins Bar or North Fork, a distance of 40 miles from the latter town. It is located in Sec. 5, T. 37 N., R. 12 W., in the Trinity Reserve, at an elevation of 5000 feet. Owner, Bobs Farm Mining Company, of Sacramento; J. H. Byers, president; W. H. Montgomery, secretary. Comprises 100 acres; located in 1883; length of ore shoot 260 feet and width 2 feet; walls are hanging, diabase; foot, quartz-porphyry; strike east and west; dip 45° N.; maximum depth 700 feet; workings consist of several tunnels, longest being 1300 feet; 6 levels from 60 to 700 feet long, 2 crosscut tunnels 300 and 600 feet in length, several raises, winzes and stopes (60 feet by 3 feet by 120 feet), all comprising several thousand feet of development work; equipment: cars, dwellings, sawmill, assay office, and 3-stamp mill and one 3-foot Huntington, run by steam and waterpower; tailings impounded in brush dam; number of men employed—mine 10, mill 2, total 12; said to have produced $350,000; lessees are working the old dump running the ore through the two mills.

Bibl.: Report X, p. 715.

Nonpareil, in Sec. 9, T. 37 N., R. 7 W., in the Trinity Center mining district, 2 miles northeast of Carrville, in the Shasta Forest Reserve. Owners, Strode Brothers. Comprises 40 acres; 2 parallel veins; ore shoot 110 feet long and 2 feet wide; strike N. 40° E.; dip 40° E.; workings, tunnel on vein 420 feet long, 150 feet of drifts and 30-foot winze; ore free milling and some high grade found; said to have produced $20,000. Idle at present.

North Star, in Sec. 32, T. 35 N., R. 11 W., in the East Fork mining district, 8 miles north of North Fork, in the Trinity Reserve.

Owner, North Star Mining Company. Comprises 160 acres; located in 1884; 8 veins in all, being an extension of the Enterprise lode; strike northwest and southeast; dip S. 30° W.; length of ore shoot 300 feet, width 4 feet; free milling ore; walls are quartz-porphyry; 950-foot tunnel, drifts and stopes comprise several hundred feet of development work; greatest depth 400 feet; equipment: dwellings, 10-stamp mill driven by waterpower from east fork of North Fork of Trinity River through 1-mile ditch; ore bins, assay office; said to have produced $200,000. Idle at present.

Bibl.: Report XIII, p. 458.

Oriole, in Sec. 22, T. 32 N., R. 9 W., in the Indian Creek mining district, 4 miles southeast of Douglas City. Owner, A. L. Paulson. Comprises 40 acres; located in 1894; short ore shoot 1-foot wide, in slate; free milling; 140-foot tunnel and 80 feet of drifts; one stope, 40 feet by 3 feet by 40 feet; rotary mill, 5-foot bed (Cannon Ball mill), run by waterpower from Indian Creek; worked as a pocket mine; small producer. Idle at present.

Oro Grande, in Secs. 8 and 9, T. 37 N., R. 7 W., in the Trinity Center mining district, 2½ miles northeast of Carrville, in the Shasta Reserve. Owners, Strode Brothers. Comprises 50 acres; located in 1888; elevation 2600 feet; ore shoot 120 feet long and 3 feet wide, free milling; footwall is andesite and hanging-wall is quartz-prophyry; strike northwest and southeast; dip 40° NE.; maximum depth 400 feet; workings, 2600-foot tunnel, 600 feet of drifts, raises and stope (40 feet by 2½ feet by 80 feet); equipment: cars, 3-drill compressor plant, air blower, dwellings, 5-stamp mill (650-pound stamps), run by waterpower from Hosteller Gulch through 1 mile ditch; 2 men employed; some rich ore produced; pocket taken out in 1912.

Bibl.: Report XIII, pp. 458, 459.

Ozark, in Secs. 4 and 9, T. 34 N., R. 11 W., in the North Fork mining district, 5 miles north of North Fork. Owner, D. G. Reid. Comprises 40 acres. Short ore shoots 2 feet wide in slate; free milling and high grade; tunnel, 420 feet long, 500 feet of drifts and 1 stope (40 feet by 3 feet by 60 feet); old 10-foot arrastra; about $60,000 produced, mostly from pockets. Idle.

Bibl.: Report XIII, p. 459.

Quimby, in Sec. 22, T. 7 N., R. 13 W., in the New River mining district, ½ mile north of Quimby, in the Trinity Forest Reserve. Owner, Larson Brothers. Comprises 160 acres, located in 1902; elevation, 2260 feet; tunnel 150 feet on the vein, all in ore; 2 crosscut tunnels, upper 125 and lower 400 feet long with a 122-foot raise between them; 150 feet of drifts; equipment: cars, dwellings, 6-stamp Merrill mill, and

1 Huntington and 1 table similar to Wilfley, run by waterpower using 3 Pelton wheels; ditch 1½ miles long from Quimby Creek. Ore is base to some extent, carrying copper and arsenic, so that only a 50% extraction is obtained by direct amalgamation. Two men employed. Small producer.

Ralston, in Sec. 32, T. 35 N., R. 10 W., in Canyon Creek mining district, 2 miles northeast of Dedrick, in Trinity Forest Reserve. Owner, Trinity County Bank. Comprises 40 acres; ore shoot 200 feet long in granite and 2 feet wide; 4 tunnels from 50 to 385 feet in length on the vein; 1 stope (60 feet by 3 feet by 80 feet); 2-stamp mill driven by waterpower and steam. Production to date about $40,000. Two lessees working in main tunnel. Some high grade found.

Ray, in Sec. 12, T. 33 N., R. 8 W., in the Deadwood mining district, 1 mile west of Deadwood. Owners, Danners & Hollensworth. Comprises 80 acres, on Donnelly Gulch; small vein in diabase; worked for pockets; small producer at one time; 280-foot tunnel; 200 feet of drifts. Idle.

Bibl.: Report XIII, p. 460.

Reindeer, in Sec. 3, T. 37 N., R. 8 W., in the Trinity Center mining district, 5 miles north of Carrville, in the Shasta Reserve. Owner, Wagner Mining Company of Berkeley, Cal.; C. E. Wagner, president. Comprises 60 acres, at an elevation of 2900 feet; short ore-shoot in granite, 18 inches wide; tunnel 340 feet long and 200 feet of drifts. Two men employed. Ore free milling and of good grade.

Bibl.: Report XIII, p. 461.

Ridgeway, in Secs. 6 and 31, T. 37 and 38 N., R. 12 W., in the New River mining district, 1½ miles north of Denny, in the Trinity Reserve. Owner, Ridgeway Mining Company, of Weaverville; J. T. Jones, president. Comprises 80 acres, at an elevation of 4700 feet; ore-shoot 200 feet long and 1 foot wide; diabase walls, free milling; workings consist of 1000-foot tunnel, 400 feet of drifts, stopes (60 feet by 3 feet by 100 feet), and old incline shaft 200 feet deep (caved); maximum depth on vein, 400 feet; equipment consists of two 30 h.p. boilers, dwellings and old 10-stamp mill (750-pound stamps), run by steam power. Said to have produced $80,000. Worked by lessees at one time. All ore removed. Idle.

Bibl.: Report XIII, p. 461.

Silver Grey, in Sec. 33, T. 35 N., R. 10 W., in the Canyon Creek mining district, 2 miles northeast of Dedrick, in the Trinity Forest Reserve. Owner, R. L. Carter et al. Comprises 40 acres; ore shoot 70 feet long and 15 inches wide; 380-foot tunnel and 120-foot drift and 1 stope (60 feet by 3 feet by 50 feet); 5-foot Huntington mill driven by waterpower; 1-mile ditch from east fork of Canyon Creek. Same high grade extracted. Production to date about $25,000. Two lessees working property at present.

Smith, in Secs. 30, 31 and 19, T. 36 N., R. 9 W., in the Weaverville mining district, 4 miles south of Weaverville. Owners, Paulson & Blake. Comprises 274 acres, at an elevation of 3900 feet; short ore shoot 2 feet wide; in granodiorite; 310-foot tunnel. Small pocket taken out on the surface. Idle. Only do assessment work. Vein not in place and greatest depth (70 feet) has not passed through the zone of disturbance.

Star of the East, in Sec. 13, T. 33 N., R. 8 W., in the Deadwood mining district, 1½ miles south of Deadwood. Owner, M. Brady. Comprises 20 acres, patented. Small vein in quartz-porphyry; some high grade extracted; 310-foot tunnel and several hundred feet of drifts. Idle.

Supplanter, located in Sec. 23, T. 7 N., R. 13 W., in the New River mining district, 2 miles north of Quimby. Elevation 2600 feet. Owners, J. and G. Foutes. Small stringers of high grade ore on the surface. Ore base with depth. Development work consists of several tunnels, 1200 feet of drifts, and a stope; 3-stamp mill and 1500 foot tramway from mine to mill. Worked during the winter. Small producer.

Toughnut, in Sec. 6, T. 37 N., R. 12 W., in the New River mining district, 2 miles north of Denny in the Trinity Reserve. Owner, F. Ladd. Comprises 20 acres, located in 1890; ore shoot 100 feet long and 2 feet wide; diabase foot and quartz-porphyry hanging-walls; 260-foot tunnel. Little high grade ore found. Idle.

Bibl.: Report XIII, p. 464.

Triangle, in Sec. 11, T. 33 N., R. 8 W., in the Deadwood mining district, 1 mile west of Deadwood. Owner, J. Hollingsworth. Comprises 40 acres, at an elevation of 3600 feet. Small vein in slate; 290-foot tunnel, 300 feet of drifts, and 1 stope (40 feet by 3 feet by 60 feet); said to have produced $15,000. Some high grade ore extracted. Idle.

Trinity Bonanza King, formerly known as Bonanza King Consolidated, in Sec. 14, T. 37 N., R. 7 W., in the Trinity Center mining district, 9 miles northeast of Trinity Center, in the Shasta Forest Reserve. Owner, Foster Gold Mining Company, of San Francisco. C. G. Foster, president. Comprises 130 acres, located in 1886. Elevation 6100 feet; extent of ore shoot not determined; formation, slate and quartz-porphyry; 1000-foot tunnel, drifts and stopes (100 feet by 3 feet by 70 feet). Equipment: cars, 3500-foot automatic tramway, assay office, dwellings, electric plant and 20-stamp mill (electrically driven). Idle. Producer at one time. Some rich ore milled. Four men employed in extending lower tunnel. (See photos Nos. 4 and 5.)

Bibl.: Report XIII, p. 440.

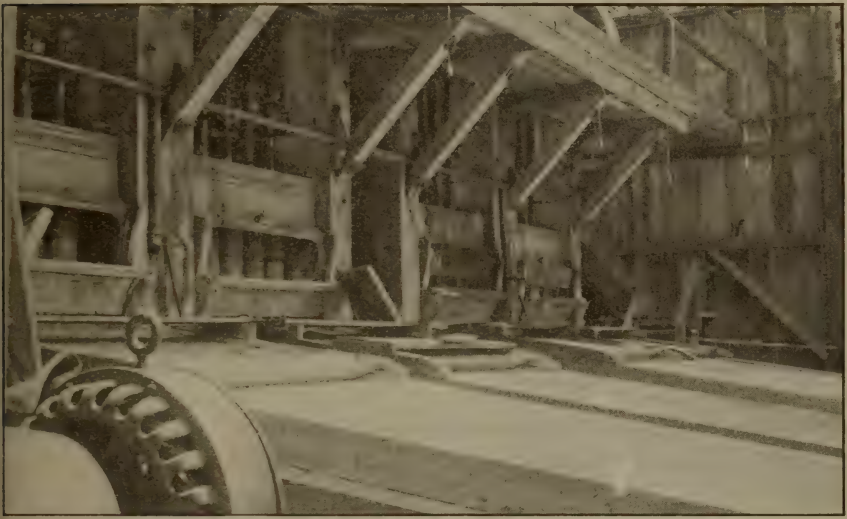

Photo No. 4. Trinity Bonanza King Mine. Interior view, 20-stamp mill.

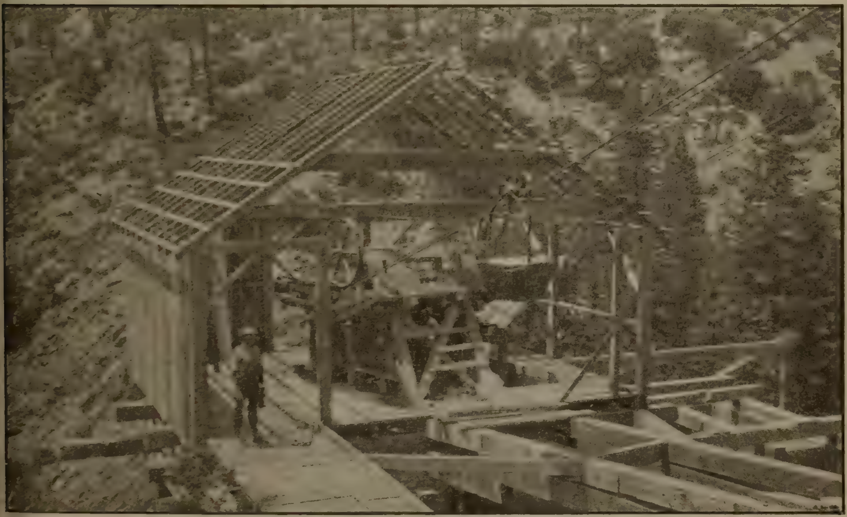

Photo No. 5. Trinity Bonanza King Mine. Automatic tram.

True Blue, in Sec. 21, T. 37 N., R. 7 W., in the Trinity Center mining district, 1 mile southeast of Carrville, in the Shasta Forest Reserve. Owner, George LaBlanc; comprises 9 acres, located in 1892; elevation 3700 feet; ore shoot 80 feet long and 12 inches wide, free milling; slate foot and diorite hanging-walls; 300-foot tunnel; small pocket taken out in 1911; owner doing assessment work.

True Fissure, in Sec. 15, T. 35 N., R. 10 W., in the Canyon Creek mining district, 2 miles north of Dedrick, in the Trinity Forest Reserve. Owner, Bank of Tehama; comprises 40 acres, patented; ore shoot, 250 feet long and 4 feet wide, between schist and granite walls: 2 tunnels, 460 and 120 feet long on the vein, and 600 feet of drifts, and 1 stope; said to have produced $30,000; being worked by two lessees; strong well-defined ledge on the surface; good prospect.

Uncle Sam, in Secs. 32 and 5, T. 9 and 8 N., R. 8 E., in the New River mining district, ½ mile north of Coeur, in the Trinity Reserve. Owner, J. Cullich; comprises 80 acres; ore shoot, 110 feet long and 10 inches wide, free milling and high grade, between diabase walls; strike of vein, N. 40° W.; dip, vertical; 310-foot tunnel, 200-foot shaft, 2 levels with 600 feet of drifts, raises and stope (80 feet by 3 feet by 120 feet); equipment; two 30 h.p. boilers, dwellings, and old 5-stamp mill driven by steam power; said to have produced $60,000; idle at present.

Bibl.: Report XIII, p. 465.

Venicia, in T. 33 N., R. 9 W., in the Lewiston mining district, about 6 miles northeast of Lewiston. Owners, Roberts, Fisher & Peterson; comprises 60 acres, on Eastman Gulch; ore shoot is 250 feet long and 2 feet wide, free milling, between slate walls; strike, northwest and southeast; dip 10° S.; workings consist of 3 tunnels, from 100 to 750 feet in length, each 100 feet apart, 500 feet of drifts and a stope, 100 feet by 3 feet by 200 feet; greatest depth is 200 feet; equipment consists of cars, dwellings, and 5-stamp Hendy mill (1000-pound stamps) driven by waterpower from Eastman Gulch, through a ditch 1½ miles long; 2 men employed in the mine; the best ore has been worked; claim a production of $500,000; been worked since 1886; custom ore treated in this mill at present.

White Cloud Pocket, in Sec. 5, T. 34 N., R. 8 W., in the Lewiston mining district, 2 miles north of Lewiston. Owner, J. W. Phillips; comprises 40 acres, patented; small vein, in quartz-porphyry; 200-foot tunnel and 250 feet of drifts; worked for pockets; $2500 pocket extracted in 1912; idle at present.

Yellow Astor, in Secs. 29 and 21, T. 35 N., R. 11 W., in the East Fork mining district, 9 miles northeast of East Fork. Owner, East Fork Development and Mining Company, of Boulder Creek, Cal.; W. S.

G. Todd, president and manager; G. H. Aram, secretary; comprises 40 acres, located in 1905; 2 tunnels, 135 and 170 feet, also 45-foot shaft, all in ore; free milling and good grade; walls are dolomite and hornblende schist; fissure vein; some ore blocked out; closed down during the winter.

GOLD PLACERS—HYDRAULIC.

Bald Point, in Sec. 33, T. 33 N., R. 9 W., in the Lewiston mining district, 4 miles southwest of Lewiston. Owner, P. M. Paulsen; comprises 120 acres, patented, on the Trinity River; depth of gravel 20 feet; slate bedrock; water from Grass Valley Creek through a ditch 12 miles long; idle for several years; rich diggings worked in early days.

Bibl.: Report XII, p. 313; XIII, p. 459.

Bartel Jacobs, formerly known as Red Hill, in Secs. 1, 2, 34, 35 and 36, T. 33 and 34 N., R. 11 W., in the Junction City mining district, 1 mile north of Junction City. Owners, H. and J. Jacobs; comprises 390 acres, of which 249 acres are patented; slate bedrock; 30 feet of gravel; water from Connor Creek through a ditch 3 miles long; equipment: 2 giants, 1500 feet of pipe, dwelling; yearly production about $4000; only snort season due to litigation over water rights; famous property and said to have a large production record; only 25 acres have been worked, with large area still remaining.

Bates and Van Matre, in Sec. 33, T. 34 N., R. 8 W., in the Lewiston mining district, 4 miles north of Lewiston. Owner, Chinese Company, of San Francisco; comprises 20 acres, patented, on the Trinity River; diorite bedrock; depth of gravel, 20 feet; water from Mooney Gulch through a ditch 2 miles long; equipment, giant, 1000 feet of pipe, dwelling; idle since 1911; has been a good producer.

Bibl.: Report XIII, p. 438.

Beaudry, formerly known as Greenhorn Gulch, in Secs. 28, 29, 20, 32, 33, 5, 6, 7, 8 and 9, T. 35 N., R. 8 W., in the Minersville mining district, 4 miles north of Minersville, in the Trinity Reserve. Owner, L. E. Whipple, of Cleveland, Ohio; E. M. Gleason, watchman; comprises 600 acres, on east fork of Stewart's Fork; diorite bedrock; 20 to 60 feet of gravel; water from east fork of Stewart's Fork through a ditch 5 miles long; capacity, 2550 inches; equipment, 3 giants, 3000 feet of pipe, dwelling; watchman on property; idle since 1910 due to litigation, only assessment work being done; good ground, and good producer at one time.

Big Creek, in Secs. 7 and 8, T. 31 N., R. 11 W., in the Hay Fork mining district, 1 mile east of Hay Fork, in Trinity Reserve. Owner, Big Creek Placer Mining Company, of Oakland, Cal.; A. E. Dawson, president; J. A. Healewood, superintendent; comprises 58 acres, on Big Creek; slate bedrock; depth of gravel 40 feet; water from Big Creek and Hay Fork River, through 2 ditches, each 2 miles long; capacity, 600 inches; 2 giants, 1500 feet of pipe; dwelling; only worked on a small scale, due to lack of water.

Big East Fork, formerly known as Oswald, in Secs. 30 and 31, T. 35 N., R. 10 W., in the Canyon Creek mining district, 1 mile south of Dedrick. Owner, A. Dannenbrink; comprises 40 acres, patented, on east fork of Canyon Creek; slate bedrock; 20 feet of gravel; equipment: 3 giants, 1800 feet of pipe, dwelling; 2 miles of ditch; 3 men employed at present making repairs; coarse gold; small amount of platinum found; good producer.

Bloss and McClary, in Sec. 5, T. 36 N., R. 7 W., in the Trinity Center mining district, ⅛ mile west of Trinity Center, in the Shasta Reserve. Owner, Sykes Mining Company, of Redding; L. McDonald, president; C. E. McDonald, secretary; comprises 136 acres, patented; elevation 2400 feet; bedrock, slate; depth of gravel 15 to 75 feet; water from Swift Creek through ditch 4½ miles long; capacity 3500 inches; head 300 feet; equipment: 3 giants, 2000 feet of pipe, and sluice boxes; 12 men employed when operating; rich benches; worked since the seventies and a good producer; under option to Alta Bert Dredging Company.

Bibl.: Report X, pp. 699–700; XII, p. 307; XIII, p. 439.

Blue Gravel, in Sec. 1, T. 31 N., R. 11 W., in the Hay Fork mining district, ½ mile east of Hay Fork, in the Trinity Reserve. Owner, D. E. Shack; comprises 40 acres, on Hay Fork Creek; slate bedrock; depth of gravel, 20 feet; water from Hay Fork River through a ditch 1 mile long; equipment: giant, 1000 feet of pipe, dwelling; small producer; idle on account of lack of water.

Blue Lead, in Secs. 6, 31 and 36, T. 33 and 34 N., R. 9 and 10 W., in the Weaverville mining district, 1½ miles north of Weaverville. Owner, T. I. Woodbury; comprises 160 acres; slate bedrock; depth of gravel, 60 feet; water from Garden Gulch through a ditch 1½ miles long; capacity 600 inches; equipment, 1 giant, 800 feet of pipe; idle; good producer at one time.

Bower & Matlock, in T. 31 N., R. 11 W., in the Hay Fork mining district, about 3½ miles southeast of Hay Fork, in the Trinity Forest Reserve. Owners, Bower & Matlock, of Red Bluff, Cal.; comprises 120 acres on east fork of Hay Fork; schist bedrock; depth of gravel, 25 feet; water from east fork of Hay Fork through a ditch 1 mile long; equipment: 2 giants, 1100 feet of pipe, dwelling; 2 men employed making repairs; short season due to lack of water; some good ground; small producer; 40 acres located as quartz claims.

Brown's Bar, formerly known as Hackerman Bar, in T. 7 N., R. 7 W., in the New River mining district, near Denny. Owner, Brackett and James Estate: comprises 140 acres; elevation 1950 feet; diabase bedrock; depth of gravel, 15 feet; water from Longtail Creek; equipment: giant, 900 feet of pipe, sawmill and dwelling; 2 men employed; small water supply, so only a few days' run each winter; gold coarse; worth $18 per ounce.

Burger, in Secs. 12 and 13, T. 34 N., R. 11 W., in the Junction City mining district, ½ mile west of Junction City. Owner, J. A. Burger; comprises 26 acres, of which 11 acres are patented; shale bedrock; depth of gravel, 30 feet; water from Gwin Gulch through Eagle and Empire ditch, 3 miles in length; capacity, 600 inches; head 120 feet; equipment: 1 giant and 1000 feet of pipe; good producer at one time. Idle.

Cacy, in Secs. 26 and 27, T. 32 N., R. 9 W., in the Indian Creek mining district, 5½ miles southeast of Douglas City. Owner, Indian Creek Placer Mining Company, of Weaverville; president and manager, H. M. Hall; comprises 65 acres, patented, on Indian Creek; slate bedrock; depth of gravel, 40 feet; water from Slate Creek through a ditch 1 mile long; idle at present; some good ground worked.

Cement and Mule Creek, formerly known as Mule Creek, in Secs. 30, 31 and 32, T. 35 N., R. 8 W., in the Minersville mining district, 1½ miles north of Minersville in the Trinity Forest Reserve. Owner, J. Skewis; comprises 150 acres, patented, slate bedrock; depth of gravel, 30 feet; water from Mule Creek through a ditch 1 mile long; capacity, 1000 inches; equipment: 2 giants, 1000 feet of pipe, dwelling; idle since 1911; 10 acres worked and over $200,000 produced.

Chapman & Fisher, formerly known as Gribble, in Secs. 18, 19, 29 and 30, T. 33 N., R. 10 W., in the Junction City mining district, 2 miles south of Junction City. Owners, Chapman & Fisher; comprises 213 acres, patented, on Trinity River; bedrock, diorite and slate; depth of gravel, 30 feet; water from Gribble and Oregon gulches, through a ditch 3 miles long; capacity, 600 inches; equipment: 2 giants, 1500 feet of pipe; dwellings: one of the best producers in this district; little platinum found, the amount decreasing last few years; worked during the winter months.

Bibl.: Reports X, p. 708; XIII, p. 442.

Clover, in Sec. 12, T. 37 N., R. 8 W., in the Trinity mining district, 1½ miles northwest of Carrville, in the Shasta Forest Reserve. Owner, A. M. Daly; comprises 106 acres; slate, bedrock; 25 feet of gravel; water from Coffee Creek through ½ mile of flume; 2 giants and 600 feet of pipe; produced about $200,000. Idle.

Corona de Oro, formerly known as the Upton, in the Lower Trinity mining district, in the Trinity Reserve. Nearest town is China Flat. Owner, Corona de Oro Mining Company, of Eureka, Humboldt County, Cal.; W. E. Olmstead, president; W. Taylor, secretary; slate bedrock; said to comprise 400 acres; water from Cedar and Hawkins Bar creeks, through a ditch 3½ miles long; equipment: giant, 300 feet of pipe, dwellings; said to have produced $1600 in eight days; 8 men employed at present, but over 40 at one time, constructing 6 miles of flume and ditch and 1100-foot tunnel, to bring water from Cedar Creek to the mine; good ground.

Curley, in Sec. 1, T. 31 N., R. 11 W., in the Hay Fork mining district, ¾ mile northeast of Hay Fork, in the Trinity Reserve. Owner, W. Leach; comprises 99 acres; slate bedrock; 25 feet of gravel; water from Hay Fork River, through Woodbury ditch 3 miles long, capacity 800 inches; equipment: 2 giants, 1600 feet of pipe, dwelling; only worked on a small scale, due to scarcity of water; small producer; some coarse gold.

Dannenbrink, in Sec. 12, T. 34 N., R. 11 W., in the Junction City mining district, 6 miles north of Junction City. Owner, C. Dannenbrink Estate; W. F. Dannenbrink, superintendent; comprises 39.94 acres; slate bedrock; depth of gravel, 30 feet; water from Gwin's Gulch, through a ditch 1 mile long; capacity 800 inches; equipment: 2 giants, 1000 feet of pipe, dwelling; 2 men employed making repairs, 6 during operating season; pays a dividend; operated from January to June.

Bibl.: Report XIII, p. 444.

Dolly Varden, in Sec. 9, T. 33 N., R. 10 W., in the Junction City mining district, 2 miles west of Junction City. Owners, Schaffer Brothers; comprises 50 acres; shale bedrock, tilted; 12 feet of gravel; water from Ox Canyon and Lime Kiln Gulch, through a ditch 1 mile long; equipment: 1 giant and 1000 feet of pipe, dwelling; operated during the winter; some good ground; producer.

Drinkwater, in Secs. 13 and 24, T. 31 N., R. 12 W., in the Hay Fork mining district, 2 miles south of Hay Fork, in the Trinity Reserve. Owner, Drinkwater Mining Company, of Oakland, Cal.; comprises 100 acres, on Kingsbury Gulch; schist bedrock; depth of gravel, 20 feet; water from Kingsbury Gulch, through 2 ditches each 2 miles long; capacity, 600 inches; equipment: 2 giants, 2000 feet of pipe, dwelling; operated on a small scale during the winter, due to poor water supply; some good gravel; small producer.

Driver, in Sec. 15, T. 33 N., R. 10 W., in the Weaverville mining district, 2 miles southwest of Weaverville. Owner, G. D. Young:

comprises 160 acres; grano-diorite bedrock; gravel 40 feet deep; water from Dutton's Creek, through a ditch 1 mile long; small producer. Idle at present.

East Fork, in Secs. 1, 2, 11 and 12, T. 36 N., R. 7 W., in the Trinity Center mining district, 3½ miles east of Trinity Center, in the Shasta Reserve. Owners, M. MacWaine et al., comprises 520 acres on east fork of Trinity River; bedrock slate; depth of gravel, 15 to 60 feet; water from east fork of Trinity River, through a ditch 3 miles long; capacity, 1000 inches; head, 300 feet; equipment: 3 giants, 2500 feet of pipe; dwelling; 10 men employed when in operation; benches, rich in places; producer.

Eastman, in Secs. 33 and 34, T. 34 N., R. 8 W., in the Lewiston mining district, 4 miles north of Lewiston. Owners, Jim Sing et al Comprises 114 acres, patented, on Trinity River at mouth of Eastman Gulch; diorite bedrock; depth of gravel, 30 feet; water from Eastman Gulch through a ditch 5 miles long; capacity 1000 inches; equipment, 2 giants, 2000 feet of pipe, derrick and dwelling; 3 Chinese employed; good producer; been worked for years; sold recently to a San Diego company.

Bibl.: Report XIII, p. 451.

Evans Bar, in Sec. 32, T. 33 N., R. 10 W., in the Junction City district, 5 miles south of Junction City. Owners, Carr Brothers. Comprises 70 acres, patented; slate bedrock; depth of gravel 30 feet; equipment, 2 giants, 1500 feet of pipe; good producer at one time. Idle at present.

Bibl.: Report XIII, p. 446.

Garden Gulch, in Secs. 1, 12, and 36, T. 33 and 34 N., R. 10 W., in the Weaverville mining district, 1 mile north of Weaverville. Owners, J. A. Wallace et al. Comprises 107 acres on Weaver Creek; water obtained through a ditch 2 miles long; capacity 1000 inches; equipment, 2 giants, 2500 feet of pipe, dwelling; 4 men employed at present making repairs, and 10 during operating season; dividend payer; some good ground.

Gem, formerly known as the Scharber, in the Lower Trinity mining district, in Trinity Forest Reserve. Owners, Teal and Perigot. Comprises 400 acres, patented, on the Trinity River; nearest town, China Flat; water from Scharber and Quimby creeks; slate bedrock; depth of gravel, 30 feet; equipment, 3 giants, 4000 feet of pipe, buildings, sawmill; 2 reservoirs; 6 men employed when in operation, from December to June; gold worth $18.50 per ounce; black sands carry a little platinum; producer.

Gold Dollar, in Sec. 33, T. 33 N., R. 9 W., in the Lewiston mining district, 4 miles southwest of Lewiston. Owner, Last Chance Mining Company, of Weaverville. Comprises 50 acres, patented, on the Trinity River; slate bedrock; depth of gravel, 20 to 100 feet; some cemented gravel 3 feet thick and boulders; water from Grass Valley Creek through a ditch 10 miles long; capacity, 2500 inches; equipment, 2 giants and 1500 feet of pipe. Idle. Good producer at one time.

Haas, in Secs. 7 and 12, T. 33 N., R. 10 and 11 W., 1 mile west of Junction City, in the Trinity Reserve. Owner, F. G. Haas. Comprises 102 acres on Trinity River; shale bedrock; depth of gravel 10 to 40 feet; water from Black's Gulch through a ditch 1 mile long; equipment, 2 giants, 1500 feet of pipe, dwelling; worked on a small scale; rich gravel taken out at times from old bench.

Bibl.: Reports X, p. 703; XII, p. 311; XIII, p. 448.

Hager & Haas, in Secs. 7 and 18, T. 33 N., R. 10 W., in the Junction City mining district, 1½ miles east of Junction City. Owners, Hager & Haas. Comprises 159 acres, patented, on Trinity River; elevation 1700 feet; shale bedrock; depth of gravel 10 to 30 feet; water from Black's Gulch through ditch 7 miles long; capacity 1800 inches; head 250 feet; equipment, 3 giants, 3500 feet of pipe, dwelling; yearly production from $5000 to $7000; operating cost yearly $2500; some good ground; worked from January to June.

Hang Bar, in Sec. 36, T. 31 N., R. 11 W., in the Hay Fork mining district, 4 miles southeast of Hay Fork, in the Trinity Forest Reserve. Owner, Chinese Company. Comprises 40 acres; schist bedrock; depth of gravel, 20 feet; water from east fork of Hay Fork River through a ditch 4 miles long; capacity 1600 inches; equipment, giant and 2000 feet of pipe; water supply limited; produces about $3000 per year; 3 Chinese employed.

Happy Home, in Sec. 30, T. 35 N., R. 10 W., in the Canyon Creek mining district, ½ mile south of Dedrick. Owner, F. Heurtevant. Comprises 50 acres on east fork of Canyon Creek; elevation 2400 feet; slate bedrock; 15 to 30 feet of gravel; ditch 2 miles long; produced over $400,000 from 25 acres; 3 benches; considerable coarse gold. Idle.

Haskins, formerly known as *Hatchet Creek* and *Shoo Fly,* Trinity Center mining district, ½ mile north of Trinity Center, in the Shasta Reserve. Owner, F. Petra. Comprises 128 acres, of which 53 acres are patented; slate bedrock; depth of gravel 20 to 30 feet; water from Buckeye Creek through a ditch 6 miles long; capacity 500 inches; head 150 feet; equipment, 2 giants and 1000 feet of pipe; good producer at one time. Idle at present, and only assessment work performed last few years.

Bibl.: Report XIII, p. 448–449.

Hawkins Bar, formerly known as *Trinity River Hydraulic Gold Mine,* in Secs. 28 and 29, T. 6 N., R. 6 E., in the lower Trinity mining district, in the Trinity Forest Reserve. Nearest town, China Flat. Owner, J. Smith. Comprises 340 acres, patented; located in the sixties; slate bedrock; depth of gravel 28 to 38 feet; water from Hawkins Bar Creek, through 5 ditches, having a total length of 2½ miles; equipment, giant, 1800 feet of pipe, buildings; idle since 1909; some good ground; gold worth $18.25 an ounce; a little platinum.

Bibl.: Report XIII, p. 449.

Henderson, in Sec. 13, T. 6 N., R. 5 E., 8 miles from China Flat, in the Lower Trinity mining district, in the Trinity Reserve. Owners, Ferguson and Henderson. Comprises 60 acres on Trinity River; located in 1896; slate bedrock; depth of gravel 25 feet; equipment, giant, 800 feet of pipe, 2 buildings; water from west fork of Sharburo Creek; a little platinum with the gold; small producer; bonded in 1912; adjoining mines, Top Notch and Gem.

Hook and Ladder, in Secs. 5 and 6, T. 33 N., R. 9 W., in the Weaverville mining district, 1 mile north of Weaverville. Owners, B. R. Rule et al. Comprises 124 acres; slate bedrock; depth of gravel 35 feet; water from Rush Creek through a ditch 8 miles long; capacity 600 inches; equipment, 1 giant, 1000 feet of pipe, dwelling; 2 men employed repairing ditch; yearly production about $7000 and operating costs about $2200.

Horseshoe and Homestake, formerly known as the Testy, in Sec. 18, T. 33 N., R. 9 W., ½ mile south of Weaverville, has been a good producer of placer gold for a number of years. Owner, Homestake-Ellerbrook Consolidated Mining Company, of Weaverville; W. B. Testy, president; A. J. Testy, secretary and superintendent. Comprises 170 acres; slate bedrock; depth of gravel 30 feet; use surplus water from La Grange ditch, and water from Cooper, Watson, Kenkaid and Gold Run gulches; 1 mile of ditch; capacity 300 inches; equipment, giants and 1000 feet of pipe; worked during the winter; producer.

Hydraulic Hill, in Sec. 29, T. 34 N., R. 11 W., in the North Fork mining district, in the Trinity Reserve. Owners, Lorenz Brothers. Comprises 35 acres; slate bedrock; depth of gravel 45 feet; water from Logan's Gulch through 1 mile of ditch; good producer at one time; coarse gold; only 5 acres worked. Idle.

Indian Creek and Panwocket, in Secs. 23, 26, 27 and 28, T. 32 N., R. 9 W., in the Indian Creek mining district, 4 miles southeast of Douglas City. Owner, Dr. D. B. Fields. Comprises 1667 acres, 345 acres being patented; sandstone bedrock; depth of gravel 30 to 50 feet; idle, as no water on claims, as old ditch from Indian Creek has been destroyed; some good ground.

Ingleside, in Secs. 27 and 28, T. 35 N., R. 8 W., in the Minersville mining district, 2 miles north of Minersville, in the Trinity Reserve. Owner, G. A. Seward. Comprises 60 acres; water from east fork of Stewart's Fork through a ditch 6 miles long; capacity 700 inches; elevation 2300 feet; diorite bedrock; depth of gravel 30 feet; equipment, 2 giants, 700 feet of pipe, dwelling; producer at one time; only assessment work performed.

Jacob, in Secs. 34 and 35, T. 34 N., R. 11 W., in the Junction City mining district, 2 miles north of Junction City. Owner, H. Jacob. Comprises 71 acres, patented; shale, bedrock; depth of gravel 15 to 40 feet; water from Connor Creek through a ditch 3 miles long; equipment, giant, 1000 feet of pipe, dwelling; worked on small scale; some good gravel; not sufficient water for a season's run.

Bibl.: Report X, p. 707; XIII, p. 450.

Joss, in Secs. 18 and 7, T. 33 N., R. 9 W., in the Weaverville mining district, 2 miles southeast of Weaverville. Owner, W. S. Lowden. Comprises 139 acres; slate bedrock; depth of gravel, 40 feet; water from Rush Creek through a ditch 12 miles long; equipment, giant and 1000 feet of pipe; idle; some good ground; has been a producer.

King, formerly known as *King and Bayles,* in the Trinity Reserve, on Rattlesnake Creek. Owners, King et al., of Helena. Slate bedrock; water from Rattlesnake Creek; 15 feet of gravel; 1 giant and pipe. Three men employed during operating season, lasting about four months. Coarse gold.

La Grange, formerly known as the *Ward and Trinity,* is the largest hydraulic mine in the world in active operation. It is located in Secs. 1, 12, 36, 9, 32, 6, 7, 2, 3, 11, 31, 10, 28, 29, 33, 20 and 13, T. 33 and 34 N., R. 9 and 10 W., in the Weaverville mining district, 2½ miles west of Weaverville, the county seat. It is owned by the La Grange Hydraulic Mining Company, a French syndicate. P. Bouery, manager; C. Jansen, foreman. Comprises 3,000 acres, 1200 being patented. Elevation 2200 to 3500 feet. Bedrock is slate, tilted and soft in spots; gravel bank in places is 500 feet high; loose, with some boulders; water is obtained from Stewart's Fork and Rush Creek, through 27 miles of ditches and flumes; capacity, 12000 inches; head 400 feet. Equipment very complete, consisting of several giants, pipe, sluice-boxes, electrical plant, ice plant, sawmill, shops, dwellings, and 32 miles of telephone line; sluice-boxes are 3000 feet long, 5 feet wide and 4 feet deep; iron rails, set 4 inches apart, are used for riffles; handle 1100 cubic yards of gravel per hour. Thirty men are employed all year around; more men employed when in operation, the season lasting ten months. Some of the giants are not moved for several months, due to size of the banks. Good dividend payer.

Bibl.: Report VIII, p. 638; X, p. 702; XII, p. 311; XIII, p. 452; U. S. G. S. Bulls. No. 430, pp. 51–56; No. 470, pp. 16–18· No. 540, p. 19.

Larsen, formerly known as *Mason Bar and China Creek,* in New River mining district, near Quimby, in the Trinity Reserve. Owners, Larsen Brothers. Comprises 40 acres; bedrock granite; depth of gravel 10 to 30 feet; water from China Creek. Equipment: giant, 800 feet of pipe, dwelling. Four men employed. Operated during the winter. Produced about $10,000 to date; gold is coarse and worth $18 per ounce. Small producer.

Little Joe, in Sec. 25, T. 32 N., R. 9 W., in the Indian Creek mining district, 6 miles southeast of Douglas City. Owners, Rogers Brothers. Comprises 40 acres. Slate bedrock; depth of gravel 5 to 20 feet; water from Indian Creek, through a ditch 2½ miles long; 1 giant and 1000 feet of pipe, dwelling. Producer at one time. Idle.

Log Cabin Bar, in T. 7 N., R. 7 E., in the New River mining district, in the Trinity Reserve. Owner, F. Staley. Quimby nearest town. Comprises 40 acres, located in 1904. Granodiorite bedrock; depth of gravel, 40 feet; water from Log Cabin Gulch; 1 giant, 400 feet of pipe, dwelling. Fine gold, worth $17.50 per ounce; a little platinum. Small producer. Limited water supply, hence a short operating season.

Long Gulch, in Sec. 17, T. 35 N., R. 8 W., in the Minersville mining district, 2 miles northeast of Minersville, in the Trinity Forest Reserve. Owner, F. Beaudry Estate. Comprises 120 acres, patented. Slate bedrock; depth of gravel, 50 feet. Equipment: 3 giants, 1000 feet of pipe, dwelling. Idle. Rich ground worked in early days.

Lower Buckeye, in Secs. 19, 30 and 29, T. 37 N., R. 7 W., in the Trinity mining district, 2 miles north of Trinity Center, in the Shasta Reserve. Owner, Trinity Gold Mining Company, of Ohio; E. A. Ellston, president. Comprises 140 acres on Buckeye Creek. Slate bedrock; 30 feet of gravel; water from Buckeye Creek through a ditch 2 miles long; capacity 300 inches; head 140 feet. Equipment: 2 giants and 800 feet of pipe. Some good gravel. Idle since 1911.

Lower Dutton's Creek, in Secs. 26 and 35, T. 33 N., R. 10 W., in the Indian Creek mining district, 3 miles north of Douglas City. Owners, Lorenz Brothers. Comprises 785 acres. Slate bedrock; depth of gravel, 50 feet; water from Dutton's Creek through a ditch 2 miles long. Equipment: 2 giants, 1500 feet of pipe, dwelling. Two men employed making repairs; 6 men used during operating season. Good producer; said to have produced at least $300,000 to date.

Lucky Strike and Effie Belle, in Sec. 24, T. 33 N., R. 10 W., in the Weaverville mining district, 4 miles southeast of Weaverville. Owner, J. Armentrout. Comprises 80 acres. Slate bedrock; depth of gravel, 30 feet; water from Democrat Gulch, through a ditch 1 mile long. Equipment: giant and 800 feet of pipe. Coarse gold found. Idle last two years.

McAtee Bar, in T. 7 N., R. 7 E., in the New River mining district, in the Trinity Reserve. Owner, C. S. McAtee. Comprises 60 acres, one location, the Kuntz, being made in 1853. Nearest town, Quimby. Granite bedrock; 15 feet of gravel. Equipment: 1 giant, 400 feet of pipe, 2 small reservoirs, dwelling. One man employed; working season lasts forty days. Fine gold worth $17.75 per ounce. Small producer.

Maple Creek, in Secs. 4, 5, 6, 8, 29, 30, 32 and 33, T. 32 N., R. 10 W., in the Junction City mining district, 4 miles south of Junction City. Owner, Maple Creek Mining Company, of San Francisco; F. L. Keller, superintendent. Comprises 1594 acres, of which 198 acres are patented. Bedrock, slate and diorite; depth of gravel, 25 feet; water from Dutch Creek, through a ditch 3 miles long. Equipment, 3 giants, 2000 feet of pipe, dwellings. Four men employed. Producer. Operated during the winter.

Meckel, in Secs. 13 and 14, T. 33 N., R. 10 W., in the Weaverville mining district, 1 mile southeast of Weaverville. Owners, Meckel Brothers; comprises 180 acres; diorite bedrock; depth of gravel, 20 to 100 feet; water from Democrat Gulch, through a ditch 2 miles long; capacity, 300 inches; equipment: 3 giants, 1500 feet of pipe, dwelling; 2 men employed making repairs, and 8 men during operating season; good producer; some coarse gold.

Miller, in Sec. 33, T. 34 N., R. 11 W., in the North Fork mining district, ½ miles south of North Fork. Owner, C. Miller; comprises 40 acres; equipment: 2 giants, 1000 feet of pipe, dwelling; some coarse gold; yearly production about $2000. Idle in 1912.

Monk, in Sec. 5, T. 32 N., R. 9 W., in the Indian Creek mining district, 1 mile east of Douglas City. Owner, W. Brannan; comprises 30 acres on Indian Creek; slate bedrock; depth of gravel, 5 to 20 feet; equipment: 2 giants, 1000 feet of pipe, dwelling; producer at one time; idle at present.

Morrison Gulch, in Secs. 12 and 13, T. 37 N., R. 8 W., in the Trinity Center mining district, 2 miles northwest of Carrville, in the Shasta Reserve. Owner, C. Hilton; comprises 76 acres, patented, on Coffee Creek; slate bedrock; 25 to 30 feet of gravel; water from Little Boulder Creek, through 1½ miles of ditch; equipment: 2 giants, 1500 feet of pipe, dwelling; 8 men employed during the season; good producer.

Montezuma, in Secs. 1, 2, 11 and 12, T. 33 N., R. 11 W., in the Junction City mining district, 1 mile north of Junction City. Owner, T. F. Bergin; comprises 77 acres, patented; slate bedrock; depth of gravel, 30 to 40 feet; producer at one time, but ground can not be worked any more on account of lack of water; area worked, 10 acres.

Nash, in Secs. 6, 7, 8, 28, 29, 30 and 31, T. 37 and 38, R. 9 W., in the Trinity Center mining district, 12 miles northwest of Carrville, in the Shasta Reserve. Owners, Trinity Hydraulic Gold Mining Company, Ltd., of London, England; G. Abrams, superintendent; comprises 474 acres, patented, on Coffee Creek; slate bedrock; 15 to 30 feet of gravel; water from Coffee Creek, through 3-mile ditch; capacity, 3000 inches; head 200 feet; equipment: hydraulic elevators, 5 giants, 2500 feet of pipe, dwellings, derrick; 8 men employed at present and 15 during the operating season; good producer; company also owns the "Abram & Blythe" placer properties, which are not worked.

Bibl.: Report XIII, pp. 464–465.

New River Placer, in Sec. 13, T. 6 N., R. 5 E., in the New River mining district, in the Trinity Forest Reserve. Owner, New River Mining Company, of Bakersfield, Cal.; nearest town, Quimby; elevation, 1650 feet; comprises 130 acres on Quimby Creek; granitic-porphyry bedrock; depth of gravel 22 feet; equipment: 2 giants, 600 feet of pipe, sawmill and 5 buildings; 12 men employed when in operation; coarse gold, worth $18.35 per ounce; a little platinum; season lasts 8 months; total operating costs 7 cents per yard; "high-line" ditch; producer.

Nigger Hill, in Sec. 2, T. 32 N., R. 10 W., in the Indian Creek mining district; 1½ miles northwest of Douglas City. Owner, G. Lewman; comprises 40 acres; elevation, 1700 feet; diorite bedrock; 30 feet of gravel; water from Dutton's Creek, through a ditch 3 miles long; capacity, 500 inches; equipment: 2 giants, 1000 feet of pipe, dwelling; 2 men employed, and 6 during operating season; producer.

O'Connell, in Sec. 33, T. 32 N., R. 9 W., in the Indian Creek mining district; 5 miles southeast of Douglas City. Owner, William Wallace; comprises 80 acres on Reading's Creek; slate bedrock; depth of graven, 5 to 20 feet; water from Reading's Creek, through a ditch ¾ mile long; capacity, 500 inches; equipment: 2 giants, 800 feet of pipe, dwelling; 2 men employed, making repairs; when in operation, 6 to 8 men employed; producer.

Potilla, in Sec. 11, T. 33 N., R. 10 W., in the Weaverville mining district, 1 mile west of Weaverville. Owner, F. Potilla; comprises 30 acres, on Grub Gulch; slate bedrock; depth of gravel, 20 feet; water from Grub Gulch, through a ditch 1½ miles long; equipment: giant and 800 feet of pipe; small producer; best values on bedrock.

Post & Wilson, formerly known as *Good Friday,* in Secs. 19 and 20, T. 33 N., R. 11 W., in the Junction City mining district, 2 miles south of Junction City. Owners, Post & Wilson; comprises 160 acres on Trinity River; slate bedrock; 25 to 50 feet of gravel; equipment: 2 giants and 1500 feet of pipe; some good ground; worked during winter; producer.

Potter & Humboldt, in Secs. 1, 6, 2, 5, 7 and 12, T. 34 N., R. 8 and 9 W., in the Minersville mining district, 2 miles southwest of Minersville, in the Trinity Forest Reserve. Owner, Humboldt Placer Mining Company, of Blocksburg, Humboldt County; W. Stowers, superintendent; comprises 1270 acres on Stewart's Fork; slate bedrock; depth of gravel, 20 to 60 feet; water from Stewart's Fork, through a ditch 1 mile long; capacity, 2000 inches; equipment; 3 giants, 2000 feet of pipe, dwelling; 2 men employed; good ground; producer; worked during the winter.

Poverty Flat, in Secs. 18 and 19, T. 33 N., R. 9 W., in the Weaverville mining district, 3½ miles southeast of Weaverville. Owners, Lorenz Brothers. Comprises 30 acres, patented; diorite bedrock; 20 to 30 feet of gravel; equipment: two giants, 1000 feet of pipe, dwelling; water from Brown's Creek through a ditch 6 miles long; capacity, 600 inches; operated during the winter; producer.

Quimby, in Sec. 18, T. 6 N., R. 6 E., in the Lower Trinity mining district, in the Trinity Reserve. Owners, Ferguson and Ziegler; nearest town, China Flat; comprises 100 acres, located in the early fifties; slate bedrock; depth of gravel, 25 feet; some cemented; scale—gold worth $18.50 per ounce; a little platinum; under option to Perigot and is to be drilled for dredging.

Bibl.: Report XIII, p. 460.

Railroad and Mt. Morensis, in Secs. 9, 15 and 16, T. 33 N., R. 10 W., in the Junction City mining district, 2 miles southwest of Junction City. Owners, Schaffer Brothers. Comprises 307 acres, patented, on the Trinity River; slate bedrock; depth of gravel, 30 feet; 2 giants, 600 feet of pipe; producer at one time; idle since 1910.

Red Flat, in Sec. 12, T. 34 N., R. 11 W., in the Canyon Creek mining district, 4 miles south of Dedrick, in the Trinity Reserve. Owner, Dannenbrink Estate. Comprises 55 acres, patented; slate bedrock 25 feet of gravel; water from Gwin Gulch through 2-mile ditch; capacity, 1500 inches; head, 150 feet; equipment: 2 giants, 1500 feet of pipe, dwelling; yearly production from $6000 to $10,000; total operating cost $2500; idle at present.

Roe, in Secs. 1, 6 and 31, T. 32 and 33 N., R. 9 and 10 W., in the Indian Creek mining district, 1 mile east of Douglas City. Owner, C. E. Thayer. Comprises 36 acres, patented; slate bedrock; depth of gravel, 25 feet; water from Weaver Creek through a ditch 5 miles long; capacity 600 inches; has been a good producer; idle.

Schloner, formerly known as the Rittubush, in Sec. 28, T. 33 N., R. 11 W., in the North Fork mining district, in the Trinity Reserve. Owners, H. C. Schloner et al.; comprises 88 acres, located in the fifties; depth of gravel, 10 to 40 feet; slate bedrock; old bench; water from North Fork Gulch; best pay gravel last 3 feet above bedrock; equipment: 2 giants, 1200 feet of pipe, sluice-boxes and dwellings; 2 men employed; yearly production, \$1500 to \$3000; gold worth \$18 per ounce; some platinum; worked during the winter season.

Senger, in Secs. 12 and 13, T. 33 N., R. 10 W., in the Weaverville mining district; ¼ mile south of Weaverville. Owner, J. Senger. Comprises 60 acres; grano-diorite bedrock; depth of gravel, 20 feet; water from West Weaver Creek through a ditch ½ mile long; equipment: giant and 1000 feet of pipe; good producer at one time; worked on a small scale during the winter.

Sheridan, in Secs. 18 and 19, T. 33 N., R. 10 W., in the Junction City mining district, 1 mile south of Junction City. Owner, W. J. Dyman. Comprises 104 acres, patented; shale bedrock; depth of gravel, 25 feet; water from Simpson's Gulch through a ditch 1 mile long; head, 200 feet; capacity, 750 inches; equipment: 2 giants, 1600 feet of pipe, dwelling; 2 men employed and 6 when in operation; production yearly about \$5000; profit \$3000; worked from January to May.

Bibl.: Reports XII, p. 313; XIII, p. 462.

Slate Creek, in Secs. 2 and 3, T. 34 N., R. 9 W., in the Minersville mining district, 3 miles southwest of Minersville, in the Trinity Reserve. Owner, F. Cadematori. Comprises 120 acres on Slate Creek; slate bedrock; depth of gravel, 40 feet; water from Slate Creek through a ditch 1 mile long; capacity, 500 inches; equipment: giant, 500 feet of pipe, dwelling; idle; only do assessment work.

South Fork, in Secs. 22, 23, 14 and 15, T. 6 N., R. 5 E., in the Lower Trinity mining district, in the Trinity Reserve; nearest town, China Flat, Humboldt County. Owner, South Fork Gold and Platinum Mining Company; P. P. Hammer, president; J. Kahlker, secretary. Comprises 885 acres on Trinity River; equipment: giant, 600 feet of pipe, dwelling; 1 man employed; fine gold, and black sands carry a little platinum; property involved in litigation; depend on rains for water supply; small producer.

Sowden, in Sec. 2, T. 33 N., R. 10 W., in the Weaverville mining district, 1¾ miles northwest of Weaverville. Owners, Ah Fong et al. Comprises 40 acres on Weaver Creek; slate bedrock; depth of gravel, 40 feet; water from West Weaver Creek through a ditch 1 mile long;

equipment: giant and 1000 feet of pipe; 2 Chinese employed; small producer.

Steiner's Flat, formerly known as Hurst and Eliason, in Secs. 35 and 36, T. 33 N., R. 10 W., in the Indian Creek mining district, 2 miles north of Douglas City. Owner, J. H. Lorenz. Comprises 180 acres, patented; slate bedrock; depth of gravel, 30 feet; water from Dutton's Creek, through a ditch 2 miles long; capacity, 600 inches; equipment: 2 giants, 1500 feet of pipe, dwelling; 3 men employed and 8 during operating season; production yearly from $4000 to $10,000; some good ground; old producer; gold worth $17.50 per ounce.

Sturdivant, in Secs. 7 and 8, T. 33 N., R. 10 W., in the Junction City mining district, 1½ miles east of Junction City. Owner, Trinity Gold Mining Company, of San Francisco; comprises 55 acres, patented, along the Trinity River; shale bedrock; depth of gravel, 15 to 35 feet; some coarse gold found; idle.

Ten Cent Gulch, in Secs. 6 and 31, T. 33 and 34 N., R. 9 W., in the Weaverville mining district, 2 miles northeast of Weaverville. Owner, M. L. Woodbury. Comprises 69 acres, patented, at an elevation of 2400 feet; slate bedrock; depth of gravel, 20 feet; water from East Weaver Creek through a ditch 2 miles long; equipment: 1 giant, 1000 feet of pipe, dwelling; leased to Chinese company; Sing Lee, manager; 2 Chinese employed; small producer; about 10 acres has been worked; some good ground.

Tener, in Sec. 30, T. 8 N., R. 8 E., in the New River mining district, in the Trinity Reserve. Owners, W. L. and R. W. Tener. Comprises 240 acres; slate bedrock; depth of gravel, 25 feet; water from Slide and Emigrant Creeks, through flume 1½ miles long and 1000 feet of ditch; equipment: 2 giants, 1600 feet of pipe, sawmill, buildings, derrick; 25 men employed installing equipment; 6 prospect shafts have been sunk to bedrock and good pay found; new location; going to work bottom of Slide Creek.

Texas Bar, in Sec. 6, T. 32 N., R. 9 W., in the Indian Creek mining district, ½ mile north of Douglas City. Owner, G. Vitzthum. Comprises 50 acres; slate bedrock; depth of gravel, 5 to 20 feet; water from Indian Creek through a ditch 3 miles long; equipment: 3 giants, 1500 feet of pipe, dwelling; 2 men employed making repairs, and 8 men during operating season; good producer.

Tolly Hill, in Sec. 34, T. 35 N., R. 9 W., in the Minersville mining district, 3 miles west of Minersville, in the Trinity Reserve. Owner, J. H. Cummings. Comprises 160 acres, on Bear Gulch; slate bedrock; depth of gravel, 50 feet; water from Bear Gulch through a ditch 1½ miles long; capacity 40 inches; equipment—giant and 700 feet of pipe; idle; producer at one time.

Top Notch, in Secs. 12 and 13, T. 6 N., R. 5 E., in the Lower Trinity mining district, 8 miles from China Flat, in the Trinity Reserve. Owners, Ranny and Holliday. Comprises 160 acres, located in 1905; slate bedrock; depth of gravel, 30 feet; water from west branch of Sharber's Creek through a ditch 1 mile long; capacity 500 inches; equipment—giant, 800 feet of pipe, dwelling; fine gold, valued at $18.57 per ounce; 1 ounce of platinum to 6 of gold; use the outfit owned by the Henderson mine; worked during the winter; small producer; adjoins the Henderson, Gem, and Negunda.

Trinity Consolidated Hydraulic, in Secs. 1, 3, 7, 18, 8, 31, 6, 14, 32, 33, 2, 35 and 36, T. 33 N., R. 8, 9 and 10 W., in both Weaverville and Indian Creek mining districts, near the towns of Weaverville and Douglas City. Owner, Trinity Consolidated Hydraulic Mining Company, an eastern corporation; general manager, D. W. Shanks, of Weaverville; J. Murphy, superintendent; comprises 2420 acres, of which 700 are patented; slate and diorite bedrock; length along channel, 3 miles; depth of gravel, 50 to 400 feet; water from east Weaver Creek, through the old Cooper and Watson Ditch; also from east fork of Weaver Creek, through Sloan ditch; also from Grider Gulch; total length of ditches, 22 miles, capacity, 5000 inches; equipment: giants, several thousand feet of pipe, 1000 feet of 22-inch siphon and 500-feet suspension bridge, dwellings; 15 men employed at present; 40 men during the operating season; ranks next to the La Grange as a hydraulic mine; consolidation of several famous properties such as the Union Hill, McMurray and Hupp, Red Point, Bartolet, Douglas City, Ford & Foley and Harvey; good producer; several millions produced from these old holdings.

Bibl.: U. S. G. S. Bulls. No. 430, pp. 51–56; No. 470, pp. 16–18; No. 540, pp. 18–19.

Trinity River Mining Company, in Secs. 5 and 8, T. 33 N., R. 8 W., in the Lewiston mining district, 1½ miles north of Lewiston. Owner, Trinity River Mining Company, of Oakland; Charles Heyer, president; W. R. Thomas, secretary; under lease to Horseshoe Placer Mining Company; W. E. Procter, superintendent; comprises 600 acres, of which 103 acres are patented, on Trinity River; diorite bedrock; depth of gravel, 30 to 40 feet; waterpower obtained from Trinity, through a tunnel 1400 feet long, 12 feet wide and 10 feet high; equipment: Hendy 24-inch pump, turbine water wheel (1000 h.p.), rope transmission, 2200 feet of pipe, dwellings; water pumped from tunnel into elevated sluiceboxes; 12 men employed; rich diggings on the blue channel in early days; leasing company constructing concrete dam, 340 feet long, 3 feet on bottom, 6 feet on top, and 18 feet deep, to divert all of the water in the Trinity River through the tunnel, so as to work the bed of this stream; holding company began work in 1905 and spent $142,000; tunnel cost $54,000 (all hand work); no production as yet; some good ground, going better than $20 per cubic yard, has been worked on the "blue lead," a noted pay channel.

Bibl.: U. S. Geol. Sur. Bull. No. 540, p. 20.

Valdor, formerly known as Huertevant, in Secs. 1, 2, 26, 27, 34, 35 and 36, T. 33 and 34 N., R. 11 W., in the Junction City mining district, 1½ miles north of Junction City. Owner, M. Huertevant; comprises 845 acres, of which 786 acres are patented; schist bedrock; depth of gravel, 30 feet; water from Conner and Cannon creeks, through 2 ditches, one 3 miles long and the other 7 miles; equipment: 2 giants, 150 feet of pipe, dwellings; being prospected for dredging possibilities by W. Johnson; 5 men employed; land under bond to McCray et al.; said to be good dredging ground; producer.

William Morris, in Sec. 25, T. 32 N., R. 9 W., in the Indian Creek mining district, 5¾ miles southeast of Douglas City. Owners, William Morris et al.; comprises 80 acres, patented; slate bedrock; 5 to 20 feet of gravel; water from Kline Creek, through ditch ½ mile long; capacity, 200 inches; equipment: giant and 800 feet of pipe; water supply limited; small producer.

Woodbury, formerly known as MacParlane, in Sec. 35, T. 31 N., R. 11 W., in the Hay Fork mining district, 3 miles southeast of Hay Fork, in the Trinity Reserve. Owner, Chinese Company, of Hay Fork; comprises 40 acres; schist bedrock; depth of gravel, 20 feet; water from Hay Fork Gulch through a ditch 4½ miles long; capacity, 1200 inches; equipment: 2 giants and 1000 feet of pipe; worked on a small scale; poor water supply; good ground; small producer.

GOLD PLACERS—GROUND SLUICING.

Blue Jib, in Sec. 13, T. 37 N., R. 8 W., in the Trinity Center mining district, 1½ miles northwest of Carrville, in the Shasta Forest Reserve. Owners, Graves & Carter; comprises 20 acres on Coffee Creek; slate bedrock; depth of gravel, 20 feet; water from Coffee Creek, through a ditch ½ mile long; small reservoir; small producer; some good ground; worked during the winter.

Boyd, in Sec. 28, T. 8 N., R. 8 E., in the New River mining district, 1 mile south of Denny, in the Trinity Reserve. Owner, A. Boyd; comprises 20 acres, on Emigrant Creek; schist bedrock; depth of gravel, 10 feet; water from Emigrant Creek, through a ditch ½ mile long; equipment: 500 feet of pipe and dwelling; small producer; coarse gold

Haunted Bar, on Eagle and Slide creeks, in New River mining district, in Trinity Reserve. Owner, J. L. Mushick; comprises 100 acres; 900 feet of ditch and dwelling; coarse gold; a little platinum; worked nine months of the year; small producer.

Lucky Strike, on east fork of New River, about 2½ miles above the mouth of Pony Creek, in the New River mining district, in the Trinity Reserve. Owner, C. Schwelder; comprises 60 acres; schist bedrock; 15 feet of gravel; ½-mile ditch; small producer.

Negunda, in Sec. 12, T. 6 N., R. 5 E., in the Lower Trinity mining district; post office, Burnt Ranch. Owner, H. Zeigler; works bed of slough; small producer.

Stribbling, in North Fork mining district, on Grizzly Creek. Owner, P. T. Stribbling; comprises 40 acres; grano-diorite bedrock; coarse gold; small producer.

GOLD PLACERS—DRIFT.

Buckeye, in Sec. 19, T. 37 N., R. 7 W., in the Trinity Center mining district, 3 miles northwest of Trinity Center, in the Shasta Reserve. Owner, J. Larson; comprises 40 acres, on Buckeye Creek; slate bedrock; depth of gravel 50 feet; tunnel 60 feet long, 4 feet by 7 feet; worked on small scale; good ground.

Ellston, formerly known as Self-Shooter, in Sec. 7, T. 36 N., R. 12 W., in the New River mining district, 2 miles south of Denny, in the Trinity Reserve. Owner, R. Ellston; comprises 20 acres on Emigrant Creek, slate bedrock; depth of gravel, 20 to 60 feet; tunnel, 50 feet long, 5 feet by 7 feet; some coarse gold found; small producer.

Graves, in Secs. 29 and 30, T. 37 N., R. 7 W., in the Trinity Center mining district, 3 miles north of Trinity Center, in the Shasta Reserve. Owner, Trinity Exploration Company, of Carrville; D. Goodale, superintendent and manager; comprises 350 acres, patented, along the Trinity River; old tunnels and shafts; bedrock 20 to 60 feet deep; some rich ground; under option to Wilsie & Hammond; being prospected by drilling for dredging.

Hidden Treasure, in Lower Trinity mining district, on west side of Trinity River. Owner, J. B. McDonald; comprises 60 acres, located in 1903; bedrock is slate; depth of gravel, 40 feet; running tunnel, present length being 65 feet; size 4 feet by 7 feet; not on bedrock; prospecting his ground; some good gravel.

Rainbow, in Sec. 33, T. 38 N., R. 8 W., in the Trinity Center mining district, 6 miles northwest of Carrville, in the Shasta Reserve. Owner, Rainbow Mining Company, of Carrville, A. Patton, president; slate bedrock; 20 to 50 feet of gravel; comprises 60 acres on Coffee

Creek; tunnel, 120 feet long, 6½ by 3½ feet and old shafts, 40 to 50 feet deep; some rich ground worked; small producer.

Bibl.: Report XIII, p. 460.

Sam Hampton, in Secs. 16 and 17, T. 35 N., R. 8 W., in the Minersville mining district, 4 miles north of Minersville, in the Trinity Reserve. Owner, C. E. Wright; comprises 80 acres, on east fork of Stewart's Fork; slate bedrock; depth of gravel, 30 to 50 feet; tunnel 80 feet long, 4 feet by 6 feet; water from east fork of Stewart's Fork through a ditch ¾ mile long; idle; worked during the winter; owner trying to find another pay channel.

Snow Gulch, in Sec. 20, T. 37 N., R. 7 W., in the Trinity Center mining district; 3 miles north of Trinity Center, in the Shasta Reserve. Owner, G. Abrams; comprises 35 acres on Snow Gulch; tunnel, 60 feet long, 4 feet by 6 feet, another 40 feet, and 4 feet by 6 feet; old shaft 40 feet deep; good producer.

Wilker, in Sec. 5, T. 39 N., R. 7 W., in the Trinity Center mining district, ¾ mile north of Trinity Center, in the Shasta Reserve. Owner, J. E. Crawford; comprises 160 acres on Hatchet Creek; schist bedrock; depth of gravel, 10 to 45 feet; tunnel 80 feet long, 3½ feet by 6½ feet; equipment: car, 500 feet of pipe, dwelling; water from Hatchet Creek through a ditch 1 mile long; some coarse gold; small producer.

GOLD DREDGING.

The known dredging fields in Trinity County are located along the Trinity River, near the towns of Trinity Center, Lewiston, and Junction City, and consists of several thousand acres. Two dredges are in operation at the present time, one at Trinity Center, and the other at Lewiston. The ground near Junction City has been drilled and the installing of a dredge is contemplated.

Bibl.: Bull. No. 36, pp. 102–104; No. 57, p. 11; U. S. G. S. Bull. No. 540, p. 19.

Alta Bert, in Secs. 8, 9, 4, 5, 32, 33 and 29, T. 36 and 37 N., R. 7 W., in the Trinity Center mining district, in town of Trinity Center, in the Shasta Reserve. Owner, Alta Bert Dredging Company, of San Francisco; H. Peake, president; W. W. Johnson, secretary; W. H. Christie, vice-president and manager; M. Ashley, superintendent. Comprises 2000 acres, patented, along the Trinity River. Slate and granodiorite; depth of gravel, 15 to 40 feet; loose and easily worked; gravel channel in places over ½ mile wide. Dredge is of the Oroville type with 5½-foot bucket, operated by electricity from Trinity Power Company; sawmill, capacity 15,000 feet per day; shops, office and several dwellings. Eighteen men employed. Company has acquired large number of old placer claims; also have an option on the Bloss & McClary hydraulic mine. Alta Bert is said to exceed the LaGrange hydraulic mine in production. Some very rich gravel. (See photo No. 6.)

Bibl.: Bull. No. 36, p. 104; U. S. G. S. Bull. No. 540, p. 19.

Photo No. 6. Dredge of Alta Bert Dredging Company.

Trinity Gold Dredge Company, formerly known as *Blakemore and Rocky Bar,* in the Lewiston mining district, in Secs. 32, 33 and 28, T. 34 N., R. 8 W., 4 miles north of Lewiston. Owners, Trinity Gold Dredge Company of Chico; H. E. Chesboro, president; manager, E. L. Smith; superintendent, H. Harris. Comprises 900 acres, patented, along the Trinity River. Slate bedrock; depth of gravel, 40 feet; loose and easily worked; dredge of Oroville type built by New York Engineering Company, with 11-foot bucket, and no stacker but run tailings on a 200-foot sluice-way floated on a barge, with iron rails for riffles, and no plates used; shops; 1500 h.p. electrical plant, with 5 miles of power line; dwellings; 15 men employed; pays dividends; been in operation since 1911.

Bibl.: Bull. No. 36, p. 104; U. S. G. S. Bull. No. 540, p. 20.

GRANITE.

The granite in Trinity County is principally a hornblende granite, and where not decomposed generally shows the effect of strong pressure. These fracture planes and the quartz seams cutting through the rock render much of it unfit for commercial use.

In the Rush Creek quarry, formerly worked by Masterson & Armstrong, of Redding, the hard boulders found in the soft mass of weathered granite were used for ornamental and monumental purposes. This deposit is in Sec. 26, T. 34 N., R. 9 W., M. D. M., on Rush Creek, 6 miles east of Weaverville, the county seat.

Bibl.: Report XII, p. 387; Bull. No. 38, p. 57.

IRON.

Iron ore deposits are reported in several localities in the county, but none of the merit have as yet been developed. In Secs. 4, 5, 9 and 10, T. 30 N., R. 10 W., M. D. M., on the northwest side of Chauchelulla Peak, stringers of iron ore are found lying in contact with large bodies of hypersthene, and the superficial resemblance of the latter material to iron ore may have caused the claim of large outcrops of iron ore in that vicinity.

Bibl.: Bull. No. 38, p. 305.

LIMESTONE.

Limestone is found in many places in this county, a belt of Devonian limestone, associated with igneous rocks, is found running parallel with the South Fork of the Trinity River from its source to Hoopa Valley; also a parallel belt of Devonian limestone running to the northeast of the preceding and another belt of Carboniferous limestone entering Trinity from the southeast in T. 29 N., R. 10 W., running northwest along Hay Fork River, disappearing north of Hay Fork and showing farther north on New River.

Bibl.: Bull. No. 38, p. 94; Diller-American Journal of Science, 4th Series, Vol. 15, p. 342.

On Brown's Mountain, in Sec. 21, T. 33 N., R. 9 W., M. D. M., a belt of limestone was quarried several years ago and burned in a limekiln, and the product used in the masonry of the courthouse at Weaverville. It is owned by the Southern Pacific Railroad Company.

Bibl.: Bull. No. 38, p. 94.

In the *Hay Fork Valley,* in Secs. 1, 3 and 33, T. 31 N., R. 11 W., M. D. M., a belt of limestone, exposed in places running northwest, is observed.

Bibl.: Bull. No. 38, p. 94.

A body of limestone, at the head of *Oregon Gulch,* in Sec. 3, T. 33 N., R. 10 W., M. D. M., was the source of lime in 1856, which was used in the construction of several buildings in Weaverville.

Bibl.: Bull. No. 38, p. 94.

MARBLE.

Outcrops of gray marble occur near the mouth of East Fork and near Taylor's Flat, in the Big Bar mining district; deposit has not been worked and its extent not determined.

Bibl.: Report XIII, p. 633.

MINERAL PAINT.

A body of red ocher has been used locally in Minersville, from the deposit owned by T. Bowerman, located in Sec. 15, T. 35 N., R. 8 W., M. D. M., on the east side of the east fork of Stewart's Fork. The ocher shows the blocky structure of the country rock, a highly weathered deposit of igneous origin.

Southern Pacific Railroad Company owns a deposit of similar material in Sec. 9, T. 35 N., R. 8 W., M. D. M.

Bibl.: Bull. No. 38, p. 342.

MINERAL WATER.

The Deer Lick Springs, formerly known as the Coombs, in Secs. 6 and 7, T. 30 N., R. 9 W., 9 miles southwest of Hay Fork, are the only springs in Trinity County to have the water on the market. Owners are the California Medicinal Springs Company, of New York; W. E. Joy, president. This company controls some 106 acres in all; there are 20 springs, one sulphur and the others iron. Water is bottled under the trade name of ''Nipicuro'' and is said to be good for all blood diseases. Only one spring has been developed, and the output at present is small. Reached by trail from Hay Fork. (Analysis follows.)

Bibl.: Report XIII, p. 523.

Another spring has been reported near Big Bar, in Sec. 3, T. 33 N., R. 12 W. It is owned by J. C. Pattison.

ANALYSIS OF "NIPICURO,"

A natural medicinal spring water from Deer Lick Springs, Trinity County, California.

	Parts per million	Grains per gallon
Total solids	8,560.00	496.48
Silica	24.82	1.44
Iron and aluminum (Fe and Al)	9.47	.55
Calcium (Ca)	1,521.53	83.25
Magnesium (Mg)	21.43	1.24
Sodium (Na)	1,332.05	77.26
Potassium (K)	163.17	9.14
Iodine (I)	5.19	.30
Sulphuric acid radical (SO_4)	1,504.17	87.24
Carbonic acid radical (CO_3)	53.62	3.11
Bi-carbonic acid radical (HCO_3)	436.03	25.29
Metaboric acid radical (BO_2)	Heavy trace	----------
Chlorine (Cl)	3,433.46	200.94
Oxygen to form Fe_2O_3	4.05	.23
	8,539.99	991.47
Hypothetical form of combination—		
Sodium chloride (NaCl)	3,388.04	196.51
Potassium iodide (KI)	6.79	.39
Potassium chloride (KCl)	308.26	17.88
Magnesium sulphate ($MgSO_4$)	104.33	6.05
Sodium metaborate ($NaBO_2$)	----------	----------
Calcium chloride ($CaCl_2$)	1,972.64	114 41
Calcium sulphate ($CaSO_4$)	1,543.67	89.53
Calcium carbonate ($CaCO_3$)	89.36	5.18
Calcium bi-carbonate ($Ca(HCO_3)_2$)	756.94	43.90
Iron oxide and alumina (Fe_2O_3 and Al_2O_3)	13.52	.78
Silica (SiO_2)	24.82	1.44
Hydrogen sulphide gas	117.82	6.83

Reaction, strongly alkaline.

Analysis made by Professor Sanford C. Dinsmore, United States Government Agricultural Department, Nevada State University, Reno, Nevada.

ORNAMENTAL STONES.

A prominent belt of *jasper* occurs on the divide between the north fork of Trinity River and the east fork of the north fork, showing especially in Secs. 5 and 8, T. 35 N., R. 11 W., M. D. M.

Another belt is found on Red Mountain, at the head of Prospect Creek, in the southwest corner of T. 29 N., and in northwest corner of T. 28 N., R. 11 W., M. D. M.

Garnet is found in the vicinity of Carrville. Discovered in 1899 by G. L. Carr; richly colored ouvaroite (lime-chrome garnet) in small dodecahedral crystals from 1 to 3 millimeters in diameter, deep green in color, coating seams or cavities in chrome iron.

Bibl.: Bull. No. 37, pp. 39, 53.

PLATINUM.

Platinum is found in a number of placer mines in this county, but more especially in a belt from 10 to 15 miles wide from Junction City westward down the Trinity River; also a belt running in a southerly direction and covering the east side of Hay Fork. All the mines in the South Fork section carry some platinum associated with gold. One clean-up near Junction City gave returns of 7 ounces of platinum to 240 ounces of gold, and occurs in well rounded grains. In the vicinity of Hay Fork it occurs as shot. Trinity at one time led in the production of platinum, but Butte County now ranks first on account of the recovery in the dredging operations.

Bibl.: Report X, p. 717; Bull. No. 38, pp. 346–49, 369; Bull. No. 36, p. 104.

QUICKSILVER.

Surface indications of quicksilver ores are found in several places throughout Trinity County, but active mining for this metal has only been pursued in the northeastern part of the county, between Crow Creek, a tributary to the east fork of the Trinity River, and the north fork of the east fork of the Trinity River. On the surface the country rock is serpentine, at times very much altered, probably being a product of igneous rocks. The material wherein the ore bodies form is a feldspar porphyry.

Bibl.: Reports VIII, p. 643; X, pp. 716–17; XII, pp. 371–72; Bull. No. 27, pp. 192, 193, 195; U. S. G. S., Monograph XIII, p. 366, 1888.

Altoona Quicksilver Mine, in Sec. 22, T. 38 N., R. 6 W., M. D. M., comprises the Trinity, Altoona and part of the Blockade mining claims, in the Shasta Forest Reserve, about 15 miles northeast of Carrville. It is owned by the Altoona Quicksilver Mining Company, of San Francisco. The holdings consist of several hundred acres of patented land; elevation, 4700 feet; acquired by this company in 1875, but prior to this time considerable quicksilver was extracted from surface workings. It was closed down from 1879 to 1894, on account of lawsuits. Some work done since 1894. There are four veins, three coming together at the lowest level, forming a mineralized zone 400 feet long, and from 4 to 50 feet wide; walls are quartz-porphyry; workings consist of a vertical shaft 450 feet deep, with 5 levels. In the lowest level, another shaft, 152 feet deep was sunk, from which 2 levels were driven. There are 7 levels in all, covering a territory of 1600 feet in a northwest and 1120 feet in a northeast direction, within which 4 different veins were worked to a depth of 600 feet. Mine makes considerable water, and was shut down in 1902, when fire destroyed part of the reduction plant, which has since been repaired. The reduction plant consists of a Knox & Osborne ore furnace. Several buildings on the property. It is the only quicksilver producer in the county, but only a few hundred dollars worth of this metal has been the yearly output in recent years. Up to 1903 this mine produced 29,181 flasks. The old dump is now being worked. Water in the lower levels

Bibl.: Reports VIII, p. 643; X, p. 716; XII, p. 371; Bull. No. 27, p. 192; U. S. G. S., Monograph XIII, p. 366, 1888.

Carr, consisting of one claim, in Sec. 22, T. 38 N., R. 6 W., M. D. M., is only slightly developed by open cuts, exposing a little ore. It is owned by G. Carr, of Carrville.

Bibl.: Bull. No. 27, p. 193.

Integral, a small quicksilver producer a few years ago, is located in Secs. 14, 15, 21, 22, 23, 27 and 28, T. 38 N., R. 6 W., M. D. M., near Altoona, and in the Shasta Forest Reserve. It is owned by the Integral Mining Company, of San Francisco; E. W. McGraw, president. The holdings consist of 46 claims, and several sections of timber land. Ore occurs in lenses, but no large bodies exposed in the workings, which consist of a shaft 180 feet deep, 5 levels, a winze 120 feet deep, connecting the lower level with a tunnel 2760 feet long; also a few hundred feet of drifts; considerable amount of surface work has been done. Reduction equipment consists of a 24-ton Knox & Osborne furnace. Several buildings on the property. Only do assessment work.

Bibl.: Report, XII, p. 373; Bull. No. 27, pp. 193–194–195.

Trinity, consists of three claims, undeveloped, in Secs. 21 and 22, T. 36 N., R. 6 W., near the Carr prospect. Owned by Rieschling Brothers. Idle.

Bibl.: Bull. No. 27, p. 195.

SOAPSTONE.

Soapstone is found on Brown's Mountain, in Sec. 21, T. 33 N., R. 9 W., M. D. M., the croppings having a light gray color. It does not weather nor harden when exposed to the air. When put in the fire it does not disintegrate, and is used as fireproof material in fireplaces.

Bibl.: Bull. No. 38, pp. 353, 371.

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	Page
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Report IV	33, 158, 170, 310, 358.
Report V	69.
Report VI (Part 1)	102, 104, 106, 120, 127. Part 2, Page 188.
Report VII	189.
Report VIII	637, 643.
Report IX	262.
Report X	695, 727.
Report XI	480, 484.
Report XII	62, 63, 307, 314, 371, 372, 387.
Report XIII	56, 64, 437–368, 523, 560, 561, 603, 604, 623, 633, 644.

	Page
Bulletin No. 27	192, 193, 195.
Bulletin No. 36	102–104.
Bulletin No. 37	39, 53.
Bulletin No. 38	54, 94, 264, 272, 305, 306, 342, 346–349, 353, 360, 362, 363, 369, 370, 371, 375.
Bulletin No. 50	140–150.
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Year	Page
1902	239, 253.
1903	173, 175, 176.
1904	165, 166, 169–173, 177.
1905	115, 164, 165–169, 172, 182–184.
1906	178–185, 197.
1907 (Part 1)	120, 189–193, 196, 198, 199, 228, 229.
1908 (Part 1)	316–320, 324–326, 347, 353, 354.
1909 (Part 1)	261–265, 268, 269, 286, 287.
1910 (Part 1)	349–354, 358, 359, 379, 380.
1911 (Part 1)	465–470, 473–476, 501–503.
1912 (Part 1)	571, 572, 574–577, 584–586, 600, 602, 631, 632.

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	Page
Bulletin No. 193	51–54.
Bulletin No. 196	9–24, 41–44, 52, 64, 1902.
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El Dorado County, Showing Boundaries of National Forests	.20
Madera County, Showing Boundaries of National Forests	.20
Placer County, Showing Boundaries of National Forests	.20
Shasta County, Showing Boundaries of National Forests	.20
Sierra County, Showing Boundaries of National Forests	.20
Siskiyou County, Showing Boundaries of National Forests	.20
Trinity County, Showing Boundaries of National Forests	.45
Tuolumne County, Showing Boundaries of National Forests	.20
*Mother Lode Region	----
Desert Region of Southern California	.10
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Copper Deposits in California	.05
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Samples (limited to three at one time) of any mineral found in the state may be sent to the Bureau for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

December, 1916.

INDEX.

PAGE
A and B mine 14
Abbie L. mine 136
A B C mine 693, 702
Abbott and Hickox gypsum deposit 515
Abbott mine 189, 202, 226, 229
  limestone near 206
  natural gas in 229
Abby mine 439
Able claim 651
Abram and Blythe placer mine (*see* Nash)
Abrasives (*see* Garnets; *also* Volcanic Ash)
Academy Granite Co. 465, 466
Accident mine 486, 777
Ackers claim (*see* Expositor mine) 539
Acme mine 14
Adams Exploration Co. 889
  Springs 207, 211
Adelaide mine 575
Aden mine 575
Adobe Valley quicksilver mine 632
Advance Consolidated mine 777–778
Advance mine 822, 825
Aetna Consolidated (*see* Aetna Quicksilver)
  mine; *see also* Amador Gold) 66
  quicksilver mine 228, 262
    concentration at 228, 283, 284
  springs 276
Afterthought mine 68, 758, 759, 760–761, 806, 809
  ore values at 761
  smelter of 760
Agassiz Needle 430
Agricultural products of Fresno Co. 432
Agua Caliente district 482
  springs, San Diego County 721
  springs, Sonoma County 334
Aguajita claim 656, 659
Aguanga Mountain, beryl on 692
  gem district 702
  "Nile Green" tourmaline in 703
Agua Rica hot sulphur spring (*see* Boyes)
Aguillon quarry 353
Ahlgren mine (*see* Russian Hill)
Ah Wai drift mine 600
Air Compressor springs 520
"Akoz" 602
Alabama mine 136
Alameda County magnesite production 262, 271
  mine 136
Alaska mine 884
Alata Lime & Brick Co. 756
Albert N. group 206
Albertz magnesite deposit 324
Alder Glen springs 335
Alder springs 198

PAGE
Alexander chromite deposit 435
  mine 68
Alice, Babby and Cloud claims 440
Alice mine 575, 778
Allen mine 12, 401
  ranch gas well 310
  springs 211
Allgood & Castell 860
Allison mine 14
Almaden, Incandescent and Tunnel site group 343
Alma mine 14
Almandite (*see also* Garnet) 320
Alpha and Omega mine 68
Alpha claim 656, 658
  mine (*see* Five Oaks; *also* West Eureka)
Alpine mine 15, 68
Alta Bert Dredging Co. 902, 918–919
  California mine 382
  mine 66, 68
Altamont copper group 319, 343
  Medical springs 335
Altar district, Sonora, Mexico, extension of in Imperial County 724
Alto gold mine 629
Al Toland mine 778
Altoona quicksilver mine 923
"Alum" springs 224
Aluminum plates, use of, in platinum recovery 377
Alvarado mine 697
Amador County 3–53
  asbestos in 4, 5
  brick in 4
  chrome in 4
  clay products in 4, 5–11
  coal in 4, 11
  copper in 4, 12–14
  fire clay in 3, 11
  geology of 4, 12
  glass sand in 4, 10
  gold in 4, 14–52
  iron and manganese in 52
  lime and limestone in 4, 52
  manganese in (*see* Iron)
  marble in 4, 53
  mineral products of 4
  Mother Lode in 4
  quartz sand in 4
  sandstone in 4, 53
  silver in 4
  soapstone and talc in 4, 53
  stone industry in 4
  tailings storage in 4, 33, 34
  talc in 53
  transportation facilities to 3
Amador Gold mine 15
  Improvement Co. 16
  King mine 15

PAGE

- Amador Gold mine—Continued.
  - Lime Rock Co. 52
  - marble quarry 53
  - Queen mine 15
  - Queen No. 2 16
  - Reduction Works 16
- America claim 660
  - mine 484, 486
  - tungsten in 522
- Ama Oro mine 15
- Amblygonite, bismuth associated with 670
  - in San Diego County 694, 706–708
- American claim 660
- American Eagle mine 68
  - Flat mine 16
  - Geologist, reference 676
  - Girl mine 725, 728–729
  - Golden Eagle mine 486
  - Institute of Mining Engineers, bulletin of 639, 708
  - Lithia and Chemical Co. 696, 708
  - Metal. Co. 62
  - mine (*see also* Helen; *also* Pine Tree) 778
- Ammonia in mineral water 183, 185, 187, 217
- Amphibole asbestos 752, 754
- Amy Balch mine 884
- Anaconda asbestos deposit 785
- Analysis of Beltane clay 318
  - coal from Mendocino Co. 317, 318
  - copper-nickel ore 666
  - copper ores 59, 761, 762, 818
  - electric pig-iron 806
  - gypsum 739
  - Humboldt Bay cement 393
  - iron ore from The Minarets 558
  - limestone from Jacoby Creek 394
  - magnesite from Sonoma Co. 331, 332
  - manganese ore 421, 807
  - mineral paint 690
  - waters 409, 423, 717–720
  - water from Millerton spring 458
    - from Mok-Hill spring 130
    - from "Sulphur Baths" well 459
  - natural gas at Stockton 611, 614, 618
  - "Nipicuro" water 922
  - orbicular gabbro 675
  - ores of Nassau copper mine 59
  - ores of Penn copper mine 59
  - shale of Vallejo Brick Co. 301
  - silver-lead ore from near Picacho 733
- Anatrosa mine 486
- Ancha Vista spring 249
- Ancient gravel channels of Calaveras County 114
  - river channels 812, 822, 824, 843, 850, 874
  - River Corporation 121
- Andalusite in Madera County 539
- Anderson, Dr. Winslow 208, 423, 808, 868
- Anderson mine 575–576, 858
  - prospects (quicksilver) 230
  - springs 212
- Andradite (*see* Garnet)

PAGE

- Angel Island quarry (*see* Fort McDowell)
- Angels Camp mines 65, 66
  - marble quarry 129
  - mine 54, 65, 66, 68, 69
- Anita mine 16
- Antelope claim 656, 657
  - Crystal Salt Co. 191
  - Valley marble quarry 520
- Anthony, C. E. 636
- Antimony Consolidated mines 475
- Antimony in Kern Co. 472–474, 475–476
  - in San Diego County 670
  - with copper ores 758
- Antone quarry 870
- Apache mine 440–441
- Apatite in San Diego County 705, 717
- Aposozein Manufacturing Co. 602
- App mine 133, 136
- Aquamarine in San Diego County 692
- Aragonite (*see also* Onyx marble) 175, 188, 310, 311
- Arambide and Aurecoechea claims (*see* Pacific)
- Arbona mine 137
- Arcata, coal near 399
- Archer mine 462
- Archer tract prospect (copper) 319
- Argentum mine 137
- Argonaut mine 4, 17–19
  - vein, vertical cross-section of 17
- Ariel mine 69
- Arizona group 487
- Arkansas, Black Bull and Arrastra claims 441
- Arkansas Traveler mine (*see* Gambetta)
- Armstrong mine 884
- Arnold, Ralph 637, 643, 708
- Arps mine 761
- Arrastra at Providence mine 448
- Arroyo Seco mine 19
- Arsenic with copper ore 768
- Artesian belt of Kern County 472
  - wells at Upper Lake 225
  - wells, natural gas from 527
- Arthur mine 69
- Artru mine 576
- Assay values of copper ores 761, 762, 818
  - of placer gold 388, 401, 402, 403, 404, 405, 406, 407, 903, 905, 907, 909, 911, 912, 913, 914, 915, 917
- Asbestos 5, 55
  - in Fresno County 432
    - Kern County 476
    - Madera County 538
    - Mariposa County 571
    - San Diego County 688, 689
    - Shasta County 752–755
    - Trinity County 876–877
  - tests on 754–755
- Ascondry mine 861
- Asphalt in Fresno County 432–433
  - Kern County 474, 476
  - Marin County 241, 243, 244
  - San Diego County 709
- Associated Oil Co. 432, 460, 525

PAGE
Astorg spring 224
Atchison, Topeka & Santa Fe railway 432, 467, 485, 685, 739
Atkins, Kroll & Co. 134
Atlantic mine 779
Atlas mine 137
Augers, use of, in drilling 451
Aunt Rosa mine (*see* Anatrosa)
Auriferous gravel, in Shasta County 776
    Trinity County 883
  gravels 373
  gravel, Tertiary, in San Diego Co. 652
  quartz veins in limestone 822
  veins, relation of, to peaks 821
Aurora hydraulic mine 387
Austin group 576
  Ranch spring 341
Australia mine 779
Avalanche placer mine 114
Avicula 642
Axinite in San Diego County 704

Bachelder quarry 293
Bachler mine (*see* Fresno Magnesite)
Bachman mine 69
Bacigalupi ranch quarry 353
Bacon Consolidated group 343
  mine 230
Bagdad-Chase Gold Mining Co. 162
Bag-house at Mammoth mine 768
Bailey, Gilbert E. 720, 741
Bailey mine 826
Baines mine 858
Baker Consolidated Copper Co. 770
  Gold Mining Co. 539-540
  mine 538, 826
  mine (quicksilver) 230
  soda spring 225
Bakersfield Sandstone Brick Co. 477
Balaklala mine 758, 761–762, 771
  operating costs at 762
  ore values at 762
Balboa Oil Co. 709, 710, 711
  oil well 642
  well, log of 711
Bald Eagle mine 762
  Mountain pocket mines 134
  Point mine 901
Balfron group 540
Ballena district, gold in 647, 652
  Tertiary auriferous gravel in 652
Ball magnesite deposit 325
Balsam Grove springs 456
Baltic mine 487
Banco de Oro claim 665
Banghart mine (*see* Mad Mule)
Bank of Tehama 900
  California quartz claim 576
Banner Blue Gravel mine (*see* Big Bend)
  group 729
Banner mine (*see also* Mayflower) 69, 138
  Mining Co. 845
  Peak 531
Bantam prospect 441
Barbarossa group 487

PAGE
Barbera quarry 353
Barber Mountain, Mining & Milling Co. 665
Barbour Chemical Co. 571
Barcal spring 345
Barges for rock transportation 252, 253, 258, 259
Barite (*see also* Barytes)
  in copper ore 761
Bark House Creek mine 844
Barnes quarry (*see* Craig)
Barnet sandstone quarry 53
Barona mine 667
Barrett oil (?) well 741
Bartel Jacobs mine 901
Bartels Bros. paint deposit 207
Bartlett springs 203, 207, 212–215
Bartola mine 69
Bartolet mine 915
Barton and Barham quarry 867
  and Lang mine 870
Barytes in Mariposa County 571
  in Lake County 204
"Basalt" blocks 352
Basalt in Napa County 299
  Solano County 313
  Sonoma County 352
Basco mine 70
Base ores in Shasta County 751
Bates & Van Matre 901
Battle Mountain mine 20
Baxter marble quarry 169
Bay Horse claim 731
  State mine 19
  View claim 663
Bayside Lumber Co. 393, 408
Bazinet group 540
Beach sands, gold and platinum in 375, 377, 391
Bear Canyon mine (*see* Thorn)
  Creek Spine 430
  River oil wells 412
  Tooth mine 878
  Valley Oil and Development Co. 188
Beason quarry (*see* Lichau)
Beatrice mine 70
Beaudry mine 844, 901
Beauregard mine 487
Beaver Creek district 814
    mine 859
Becker, G. F. 219, 236, 238, 347
Bedrock claim 656, 657
Behr soda spring 215
Belding mine (*see* Contention)
Belgium-Bohemian Mining Co. 834
Bella Rufin mine 488
    Union Quicksilver Co. 286
Belle Josephine mine 844
Belle mine 540
Bellevue mine 138
Bell mine 138
  Prince mine 56
Belmont claim 656, 657
  mine 20, 138
Beltane clay (*see* Weise)

PAGE
Bender mine 826
Benicia, a natural hydraulic cement at 300
cement works 302
Rock Crushing Co. (*see* Vulcan)
Ben Neil mine 826
Bennett Co. 844, 849, 856
Valley, oil seepages in 342
Benson mine (*see* Little May)
Benton mill 594
Berry mine (*see* Mud Springs; *also* Evans)
Berthenia mine 274
Beryl 438
in San Diego County 692, 700
Bieber quarry 293
Bibliography on Imperial County 743
Kern County 523
San Diego County 743
Shasta County 809
Siskiyou County 872
Trinity County 926
(For other counties see under individual mines)
Bicknell mine 138
Bigelow mine 884
Big Bend hot springs 808
Bend placer mine 114
Blue mine 478–479
Casino Gold Mining Co. 155
Chief claim (*see* Squaw)
Chief mine 884
Creek mine 901
Creek power plants 429, 430, 431, 432
Dry Creek district 440
East Fork mine 902
Four mine 70
Horn mine 70
Injun group 230
Ledge mine 825
Oak Flat district 136
Sampson mine (*see* Delilah)
Slide mine 859
Spring mine 70
Stick mine 540
Tree mine (*see* Tropico)
Biledo, Thomas, iron claims 554
Billy Williams mine 70
Bishop marble quarry 129
Bismuth in San Diego County 670
Bissell deposit, magnesite 519
Bitumen in quicksilver mines 344, 348
Bituminous sandstones 413, 425
rock (*see* Vulcan quarry)
Black Bear mine (*see also* Culver Baer) 779, 822, 826–827
Butte Mountain coal deposits 817
Diamond mine 198, 389
Eagle mine 649
"granite" 465
Hawk group 489, 522
Hawk mine 138, 779, 827
Jack claim (*see also* Delilah) 437
Lead mine (*see* Blue Gravel)
Log claim 576

PAGE
Black—Continued.
Oak mine 133, 138–140
costs at 140
direct cyaniding at 139, 140
Palangus mine 879
Prince mine (*see* Diamond)
Ranch limestone quarry 323
sands, gold in 374, 375, 391
in Del Norte County 375, 379
in Humboldt County 391
platinum in 374, 375, 391
Spider mine 779
Tom mine 795
Wonder mine 70
Blackmore mine (*see* Trinity gold dredge)
Blair mine 70
Blake mine (*see* Whistle Bar)
Blake, Wm. P. 539, 638, 724
Blanco (*see* Snowflake)
Blaney Meadows hot springs 456
Blank's sulphur spring 181
Blast furnace charge at Penn mine 61
Blazing Star mine 71
Bleaching oils by fuller's earth 308, 309
Blind Lode mine 827
Blister copper 764
Blockman marble claims 674
"Blom Patent Roaster and Fume Condenser" 446
Bloodstone claim 649
Bloomer mine 844
Bloomfield claim 656, 658
Bloss & McClary 902
Blossom claim 729
Blue and White mines 140
Bell mine 71, 577
Bird mine (*see* Lost Channel)
Gravel mine 844, 902
Gouge group 489
Hill mine 845
Jacket mine 884–885
Jay claim 656
Jay mine 71, 826, 885
Jeans mine (*see* Cub Bear)
Jib mine 916
Lakes, springs at 215
Lead mine 140, 827, 902
Ledge mine 817–818
Mountain Mining Co. 492
Bobs Farm Mining Co. 895
Boca quarry 353
Bodie mine 779
Bogan and Bataille mine 577
Boger gravel pit 433, 441, 465
Boire placer mine 114
Boitono mine 140
Bolinas Copper Co. 248
Bolytho mine 71
Bonanza King mine 876
mine (*see also* Crystal) 141, 780, 828, 885
springs 215
Bondo mine 401
Bondshu et al., marble deposit 601

PAGE
Bondurant mine 577
Bonham Ranch limestone 52
Bonneyville quartz mine 40
Bonne Terre mine (*see* Mitchell copper)
Bon Ton mine 71
Boomer mine 540
Boot Bros. gas well (*see* Workman)
Booth quartz claim 577
Borax in Colusa County 487
    Kern County 474, 477
    Lake County 203, 204, 215, 234, 240
    mineral water 175, 187, 204, 215, 221
  Lake 203, 204, 205
  springs 215
Borel power plant 473
Borg quarry (*see* Hutchinson)
Borrego spring 720
Boston group 343
  mine (*see also* Knoxville) 71
Bothing Home pottery 244
Bottle Peak claim 649
Boulder Creek Consolidated Gold Mining and Milling Co. 662
  district, gold in 647, 662
Bour molybdenum deposit 669
Bovee mine 65
Bowden mine 72
Bower and Matlock mine 902
Bowerman ochre deposit 921
Bowersox mine 845
Bowman claim 577
Boyd fuller's earth deposit 527
  gypsum deposit 527
  mine 916
  mineral paint deposit 527
  placer mine 115
Boy Edgar mine 420
Boyes hot springs 335
Boyle mine 828
Bradford mine (*see* Mirabel)
Bradley's spring 718
Bradley, Walter W. 7, 93, 94, 95, 96, 111, 173, 427, 429, 525, 531, 607, 608, 622
Brazil mine 859
Briceland Estate gas well 407, 408
  oil near 410
  Oil and Land Co. wells 412
Brichetto Bros. gravel pit 627
Brick 750, 756, 816, 817
  and tile 391, 392, 415
  clay in San Diego County 685
  cutting machine 435
  elevator 433
  in Colusa County 175, 178
    Fresno County 433–435
    Imperial County 737
    Kern County 474, 477–478
    Kings County 526, 527
    Marin County 242, 244–248
    San Diego County 685, 686
    San Joaquin County 607–610
    Solano County 300–302
    Sonoma County 316–318

PAGE
Brick—Continued.
    Stanislaus County 627, 628
    Yolo County 367
  kilns, crude oil burners in 434
    construction of 608
Bridges, stone, in Napa County 292, 293, 294
Briggs mine 606
Bright Hope mine 343, 344
  Star mine 72, 490, 780
Britton No. 1 and No. 2 claims 385
Brother Jonathan mine 481
Brown & George mine 845
  & Knowles oil well 411
  & Smith Cons. 269
  Bear mine 828, 874, 882, 885–886
  chrome deposits (*see* Little Castle Creek)
  marble deposit 198
  mine 141
  ochre (*see* Meeker)
  quarry 293
Brown, G. Chester 427, 471, 745
Browne paint mine 276
Brown's Bar mine 903
  Mountain limestone 920
  Mountain soapstone 924
Bruce mine 72
Bruner mine 72
Brunswick mine 773, 780
Brush magnesite deposit 329
Brushy Cañon mine 763
  Ridge Mining Co. 441
Brusse gem stone deposit 869
Buchanan mine 141, 538
Buckeye Bar mine 859
  Channel mine 166
  claim 344
  group 648
  mine 189, 190, 917
Buckhorn mine (*see* Red Gold)
  springs 477
Buckman Springs Mineral Water Co. 719
Buck mine 886
Buck ranch quarry 293
Buena Vista coal mine 11
  mine (gold) 72
  Lake 471
    Oil District, natural asphalt in 476
Buffalo mine 115
Building materials in Del Norte Co. 379
  Humboldt County 391–394
  Imperial County 736
  Mendocino County 415
  San Diego County 671–687
  stone at Seigler springs 223
    (*see also* granite, sandstone, tuff, etc.)
Bull Dog claim 578
  Pup claim 578
  quarry (*see* Daniel Contracting)
  Run mine 14, 490
Bulletin, American Institute of Mining Engineers 639

PAGE

- Bullion fineness at Texas Flat mine ---- 551
  - mine ---- 72, 73, 230
- Bully Choop mine ---- 886
- Bully Hill mine ---- 758, 759, 763–764, 774, 806, 809
  - base ores of ---- 763
  - copper oxides at ---- 763
  - silver in ---- 764
  - smelter of ---- 764
  - zinc in ---- 764
- Bulwer & Virginia mine ---- 780
- Bumpass' Hell, boiling springs at ---- 747
- Bund copper mine ---- 56
- Bunker Hill claim ---- 578
  - mine ---- 4, 20–22, 781
    - concentrate treatment at ---- 22
    - slime and cyanide plant ---- 22
- Burger mine ---- 903
- Burners, crude oil in brick kiln ---- 434
- Burns springs ---- 336
- Burns, Wm., mine ---- 858
- Burrows oil well ---- 411
- Burton limestone deposit ---- 865
  - R., and J. Kesterman placer ---- 441
- Busch claim ---- 578
  - mine ---- 578
- Buster Brown claim ---- 697
- Butler, James, map of San Diego Co. by ---- 645
- Butte County, platinum in ---- 923
  - Dredging Co. ---- 123, 125, 126
- Butterfly mine ---- 540, 699
- Buzzard's Roost mine ---- 141
- Bynum spring ---- 216

- Cable gem mine ---- 702
  - group ---- 654, 656, 658
- Cabrillo, discovery of San Diego Bay by ---- 637
- Cacy mine ---- 903
- Caire, J., manganese deposit ---- 622
- Cajon Mountain clay deposits ---- 687
- Calaveras Consolidated mines ---- 73
  - Cooperative Co. ---- 81
  - Copper Co. ---- 56, 62
- Calaveras County ---- 54–131
  - ancient gravel channels of ---- 114
  - asbestos in ---- 55
  - chrome in ---- 54, 55
  - clay in ---- 54, 56
  - copper in ---- 54, 56–64
  - East Belt mining districts in ---- 65, 66
  - gems in (*see* quartz)
  - geology of ---- 56, 64–66, 67
  - gold dredging in ---- 123–128
    - placer mines in ---- 114–123
    - production of ---- 54
    - quartz mines in ---- 66–114
  - graphite in ---- 54
  - gravel channels of ---- 114
  - iron in ---- 128
  - lead in ---- 54
  - limestone in ---- 54, 128, 129
  - marble in ---- 129

Calaveras County—Continued. PAGE

  - mineral paint in (*see* ochre)
    - products of ---- 54, 55
    - water in ---- 54, 130
  - Mother Lode in ---- 65
  - ochre in ---- 54, 130
  - platinum in ---- 54, 55
  - pyrites in ---- 54
  - quartz crystals in ---- 54, 118
  - railway facilities in ---- 54
  - sandstone in ---- 130
  - silver in ---- 54
  - slate in ---- 131
  - soapstone and talc in ---- 131
  - tellurides in ---- 93, 107
- Calaveras formations in San Diego County ---- 654
  - Gold Dredging Co. ---- 123–125
  - Grant ---- 629
  - mine (*see* Oromiento)
  - River ---- 623
- Calaveritas placer mine ---- 115
- Caledonia mine ---- 23, 541
- Caldwell mine ---- 490
- California Academy of Sciences publications references ---- 643
- California-American Marble Co. ---- 129
  - and Detroit Mining Co. ---- 798
  - asbestos mine ---- 55
  - Bar mine ---- 861
  - Borax Co. ---- 204, 234
  - Brick and Pottery Co. ---- 316
  - Buckhorn Mining Co. ---- 102
  - -Calaveras Mining Co. ---- 68, 629
  - China Products Co. ---- 686–687
  - claim ---- 656, 658
  - Company ---- 167
  - Consolidated mine ---- 798
  - Copper Co. (*see* Daulton)
  - Extraction Co. ---- 119
  - first geological survey of ---- 638
  - Fresno Oil Co. ---- 433
  - Fuller's Earth Co. ---- 580
  - Geysers (*see* The Geysers)
  - Gold King Mining Co. ---- 730
  - Gypsum & Mineral Co. ---- 515
  - King Gold Co. ---- 730
  - Manganese Co. ---- 630, 631
  - mine (*see also* Reed) ---- 73
  - Ochre Mining Co. ---- 630, 632
  - -Ophir mine ---- 73
  - -Oregon Power Co. ---- 811, 816, 837, 864
  - Pottery Co. ---- 56
  - Paint M. & M. Co. ---- 276
  - Road & Street Improvement Co. 487
  - Sandstone & Construction Co. ---- 808
  - second geological survey of ---- 639
  - Seltzer springs ---- 423
  - Silica Co. ---- 633
  - Slimes Concentrating & Cyanide Plant ---- 23
  - Trust Co. ---- 625
  - Vichy springs (*see* Vichy)
- Californite ---- 439, 461, 869
  - not nickel bearing ---- 461

PAGE

- Calistoga Hot Springs 277
  - quicksilver at 277
  - mine (*see* Silverado)
- Callahan district 825
- Calleaud quarry 353
- "Callustro" 299
- Calmas Mining Co. 137
- Calumet Consolidated mine 781
  - -Michigan Mining Co. 894
- Camille mine (*see* Cornmeal)
- Campbell mine 845
- Campo Seco copper district 56
  - mine 56
- Camp Rose spring 336
- Cañada de las Uvas 471
- Canal Gulch mine 859
- Canal systems in Fresno County 430
  - Kern County 472
  - Madera County 535
  - Merced County 606
  - San Joaquin County 623
  - Stanislaus County 634
- Canary mine 541
- Cane springs (*see* Kane)
- Cañon Creek district 882
- Cape Cod mine 829
- Carbondale clays 5
- Carboniferous formations at Julian 639
  - rocks in Shasta County 758
    - Trinity County 920
- Cargo Muchacho mine 725, 729
  - Range, gold mines in 725
- Carlin mine 141
- Carlotta mine 141
- Carlsbad springs 216
- Carlton mine 73
- Carnegie Brick & Pottery Co. 607, 608
  - Group, Ltd. 781
- Carp claim 656, 657
- Carpenter mine 115
  - quarry (*see* Clough)
- Carrara marble quarry 53
- Carrie mine 886
- Carrington, Chillena et al. pocket mines 142
- Carrizo Station springs 722
- Carr mine 924
- Carson Hill 65
- Caruthers mine 73
- Cascade-Combination group 662
- Cascade Mining Co. 662
- Casey mine (*see* Klein)
- Casinelli mine (*see* Rising Star)
- Cassaretto, John (gravel) 353
- Castle Crag soda springs 868
  - Rock springs 808
  - springs 216
- Cataract & Wide Awake gravel mine 115
- Cates mine (*see* John W. Cates)
- Cavanaugh mine 402
- Cavan copper mine (*see* San José)
- Cazadero, limestone near 323
- Cecilville mine 845
- Cement 262–268, 302–307, 393
  - and Mule Creek mine 903
  - blocks 318

PAGE

- Cement—Continued.
  - Davenport plant, Santa Cruz Co. 263
  - definition of 263
  - gravel, dredging cost high in 124
  - in Kern County 478
    - Napa County 262, 268
    - Solano County 300, 302–307
  - materials in Imperial County 736
    - San Diego County 684
  - natural hydraulic, at Benicia 300
  - "Portland" 263
  - process of manufacture of 263
  - "rock" pit 294
  - rotary driers for 265
    - kilns for 265, 266, 304
  - tube mills for 267, 303
  - white, use of kaolin in 318
- Centennial mine 843
- Central Eureka mine 4, 24, 25
  - Hill mine 115
  - mine 781, 829
  - Mother Lode Mining Co. 155
  - Natural Gas Co. 610–611, 616
- Centrifugal pumps used for ground sluicing 445
- Cerro de los Pozos 651
- Chalcedony 521
- "Chalk" in Shasta County 805
  - Mountain springs 224
- Chambers ranch springs 216
- Champion mine 73, 578, 829
- Chance mine 764
- Chaparral claim 656
  - Hill 65
  - mine 14, 74, 142
- Chapman and Fisher mine 903
  - and Voluntine mine 782
  - gravel mine 115
  - mine 886
- Chard, Mrs. Emma, copper claims 574
- Chariot claims 654, 656, 658
  - Mill & Mining Co. 656, 658
- Charles, L. gas well 528
- Cheerful Moments claim 656, 659
- Chehalis Oil & Mining Co. 188
- Cherokee gravel mine 166
  - mine (quartz) 74
- Cherry Hill mine 829
- Chicago mine 230
  - concrete furnace at 230
- Chicken grit 363
- Chief mine 490
- Chieftain claim 656, 658
- Chiles Valley mines (*see also* under Magnesite) 262
- Chillena mine 142
- Chimney Rock spring 336
- China Borax Lake 477
  - Creek mine 845
  - Gulch mine (*see* Hicks)
  - Paul mine (*see* Johnson)
  - Sam mine 843
- Chinese Camp, chromite near 134
  - Company 855, 901, 906
  - use of tourmaline by 691
- Chispa gravel mine 115

PAGE
Chloride mine (*see also* Globe) 882
Chlorination plants 16, 146
Chocolate Mountains 731, 732
Chollas Valley Salt Co. 716
Christensen hydraulic mine 388
Christenson ranch (copper) 205
Chrome (*see also* Chromite)
  in Amador County 4
  Calaveras County 55, 56
  Colusa County 178
  Glenn County 197
  Lake County 204
  Shasta County 750, 755
  Siskiyou County 755, 816
  Sonoma County 204
  Trinity County 877
  Tuolumne County 134
  -iron in Del Norte County 380
   Mendocino County 420
Chromite (*see also* Chrome) 204, 268
  in Fresno County 432, 435–436
  Kings County 525, 527
  Napa County 268
  Solano County 307
  Sonoma County 319
Chrysocolla 705
Chrysotile asbestos 752, 754, 877
Cincinnati Belle mine 656, 659
Cinderella mine 879
Cinnabar (*see* under Quicksilver)
  King group 344
  Mining Co. 344
City Improvement Co. quarry (*see* Violetti)
  of Colusa, sand and gravel for 195
  Street Improvement Co. quarry (*see* McDonald)
Claason quarry 353
Clamp for concrete ties 318
Clara mine 782
Clark. A. V., clay banks 6
  gas well 612
  gravel mine 26
  -McClurg Company 444
  mine 664
  (Laura F.) Oil Co. 710
  N. & Sons 5, 6
  well 720
Clary Gold Mining Co. 106
Classic Hill mine 825, 846
Clay washing plant 9
Clays (*see also* under Brick) 4, 5–11, 56, 178, 197, 204, 244, 300, 316, 367, 379, 380, 391, 392, 415, 605, 607, 629, 737, 738, 756, 816
Clear Creek district 481, 482
  dredging on 777
  Lake 202, 207
   quicksilver district 228
Cleopatra copper claims 384
Cleveland Consolidated placer mine 26
  mine (*see also* Matthai) 782, 887
  -Pacific Mining Co. 650
Clifton claim 651
Climatic conditions in Kern County 472
  Shasta County 751

PAGE
Climax mine 782
Clinker Brick Co. 527
Clinton Bar mine 26
  Consolidated mine 26
Clio mine 142
Clipper mine (*see* Carnegie)
Cloudburst Mining Co. 441
Clough mine (*see* Reward)
  quarry 353
Cloverdale mine 344, 345
Clover Flat placer mine 402
  Leaf placer mine 116
  mine 903
Clute quarry (*see* Titania)
Clyde mine (gold) 159
  mine (quicksilver—*see* Culver-Baer)
Coachella Valley 724
Coal 11, 12
Coal in Colusa County 178
  Del Norte County 380
  Fresno County 432, 436
  Humboldt County 399, 400
  Kern County 474, 479
  Lake County 205
  Marin County 248
  Mendocino County 415, 418
  Napa County 269
  San Diego County 713
  Shasta County 756–757
  Siskiyou County 811, 817
  Solano County 307
  Sonoma County 319
  Trinity County 877–878
  Yolo County 367
Coalinga coal deposits 436
  gypsum deposits 452
  oil field 431, 460, 461
Coast Range system in Siskiyou County 811
Cobalt (*see* under Nickel)
Coffee Creek district 873, 882
  Creek Mining & Milling Co. 892
  Mill mine 116
Cohen mine 579
Colby mine (*see* Sturn)
Coleman & Hill brick yard (*see* Alata)
Collar Button mine 491
Collier, D. C. & Co. 656, 658
Collier mine (copper) 57
  (gold) 74
Collings deposit 322
Collins spring (*see* Millerton)
Colorado claim 580
  mine 541, 579, 782
  Mining & Milling Co. 648
  River in Salton Basin 723
Columbia Basin mine 166
Columbia marble quarries 132, 169–172
  mine 829
Columbus gravel mine 26
  mine (quartz) 142
Colusa County 175–196
  aragonite in (*see* onyx marble)
  borax in 175
  brick clay in 178
  chrome in 178

PAGE

- Colusa County—Continued.
  - coal in 178
  - copper in 178
  - gold and silver in 179
  - gravel in 195, 196, 199
  - gypsum in 179
  - iodine in 191
  - limestone in 179
  - manganese in 180
  - mineral paint in 180
    - products of 175, 176
    - water in 181
  - natural gas in 187
  - onyx marble in 188
  - petroleum in 188
  - quicksilver in 189
  - salt in 191
  - sand and gravel in 195, 196
  - sandstone in 191
  - stone industry in 195
- Colusa sandstone 191
    - rubble from 195
    - tests on 192
  - Sandstone Company 192–194
- Comet mine 26, 74, 580
- Commercial Copper & Gold Mining Co. 838
- Commonwealth mine 482, 491
- Complexion springs 217
- Compression of gasoline from natural gas 461
- Compromise and Eubank mine 580
- Compton mine 782
- Concentrates, assay value of 34, 36, 40, 43, 47, 69, 79, 82, 90, 95, 109, 113, 137, 145, 148, 151, 159, 165, 441, 490, 494, 539, 551, 558
    - cyaniding of 22, 23, 95
- Concentration of quicksilver ores 189, 190, 227, 228, 240, 290, 291, 312
  - by oil flotation 312
- Conchilla Valley 724
- Concrete furnace at Chicago quicksilver mine 230
    - ties, clamp for 318
- Condensed mine 830
- Confidence mine 142
- Congress mine 764
  - Mining Co. 230
  - spring 278
- Conn Creek, gold on 271
- Connor mine 830
- Connors quarry 294
- Consolidated Four mine (*see* Waterloo)
  - Gold Dredging Co. 783
  - Kascinaska mine 783
  - Mines Co. 496
  - Siwash mine 861
- Constellation mine 57
- Constitution mine (*see* Constellation)
- Consuella mine 143
- Contact claim 656, 658
  - Mining & Milling Co. 441–443
- Contention mine (*see also* Bazinet) 26

PAGE

- Cook placer mine 388
- Cook's Mineral Springs 182
  - springs 410
- Cooney quarry 354
- Copa de Oro Mining Co. 71
- Copley mine 764, 783
- Copper, antimony with 758
  - arsenic with 768
  - barite with 761
  - Brick nickel mine 667
  - blister 764
  - Button mine 879
  - City mill 774
  - City ores 759
  - early shipments of 436
  - first smelter of, in California 572
  - Foothill Belt of 436, 572
  - geology of 12, 56, 134
    - in Shasta 757–760
  - gold and silver with 12, 56, 758, 768, 770, 773
  - Hill mine 12
  - in Amador County 4, 12–14
    - Calaveras County 54, 56–64
    - Colusa County 178
    - Del Norte County 373, 374, 380, 386
    - Fresno County 432, 436–438
    - Humboldt County 374, 394–399
    - Imperial County 732
    - Kern County 474, 479–480
    - Lake County 205, 206
    - Madera County 534, 537, 538
    - Marin County 248
    - Mariposa County 572–575
    - Mendocino County 374, 418–420
    - Napa County 269
    - San Diego County 665–667, 670
    - Shasta County 757–773
    - Siskiyou County 817–820
    - Sonoma County 319, 320
    - Trinity County 875, 876, 878–882
    - Tuolumne County 132, 134, 135
  - King Ltd. (*see* Hart Copper Co.)
    - mine (*see also* Hart Copper Co.) 436, 479
    - Mines Co. 435
    - Smelting Co. 271
  - lead with 758
  - matte 764, 768
  - Mountain Consolidated Mining Co. 772
  - nickel with 666, 670, 819
  - ore deposits in Shasta County 759
  - ores, assays of 761, 762, 818
  - Prince mine 206
  - Queen mine 818, 879
  - zinc with 12, 56, 58, 59, 758, 761, 765, 808, 809
- Copperopolis copper lode 56
- Copsey paint deposit 207
  - springs (*see* Spiers)
- Cordelia quarry (*see* Thomasson)
- Cornmeal mine 75

PAGE
Cornucopia Copper Mining Co. 320
Corona de Oro mine 904
  mine 276
Coronado spring 717
Corral de Luz Rancho, mineral springs on 720
  Flat mine 116
Corrine mine 783
Cortez mine 783
Corundum in San Diego County 703, 705
Corwin Oil Co. 188
Cosgrove mine 75
Cosmopolite mine 143
Cost of electric power 63, 69, 79, 95, 109, 111
  hauling from mine to rail 454, 573
  supplies and freight at Union Copper Mine 63
  well drilling for water 625
Costs, dredging 124, 125, 126, 127
  operating 496, 499, 501, 503, 507, 514, 551, 573, 606, 751, 752, 784, 793, 846, 865, 888, 893, 906, 911, 912
  various 40, 47, 50, 69, 75, 79, 90, 95, 105, 109, 112, 146, 431, 443, 454, 464, 465, 467, 477, 478, 492, 494, 496, 507, 514, 515, 518, 544, 563, 566, 571, 573, 606, 625, 761, 764, 793, 844, 846, 850, 862, 865, 878, 891, 916
Cosumnes mine 12
Cottonwood district 824
County gravel pit (Glenn) 200
  macadam quarry (Solano) 313
Court House gas well 612
Coutts Bros. quarry 354
Cove district 481, 482, 484
Cowan gas well 612
Coyote group 651
  Mountain 642
  Mountains, gypsum in 740
    marble in 674, 733–736
    nickel in 732
  Well 742
Crabtree springs 217
Craig mine 887
  quarry 355
  oil well 412
Cranberry mine 580
Crane Valley power plant 535
Crapo mine 846
Cravath mine 649, 651
Crawford placer mine 167
Crawley mine 830
Craycroft brick yard (Modesto) 627, 628
  C. J. & Son Brick Co. 633
  -Herrold Brick Co. 633–634
Creek Ledge mine 27
Creole marble group 733–735
Creon magnesite (*see* Kolling)
Cretaceous rocks in Shasta County 758
  strata in San Diego County 642, 710
Crimson group 396, 399
Crocker-Huffman Land & Water Co. 606
Croesus mine (*see* Pinmore)

PAGE
Cronin mine 846
  quarry (*see* Petaluma Rock)
Crook placer mine 388
Crossette mine 75
Cross-section of Argonaut vein 17
  Calaveras County geologic formations 67
  Stonewall mine 661
Croton Bar mine (*see* Bondo)
Crown Lead gold mine 581
  Mills gas well 612
  Peak mine 581
  Point mine 27, 75, 879
    Quicksilver Mining Co. (*see* Sonoma)
Crushed rock (*see* under Stone industry)
Crushed stone in Imperial County 736
Crystal Gem mine 693, 703
  group (copper) 764
  mine (*see* also Pacific) 491, 784
  Spring mine 541
Crystalline mine 143
Cub Bear & Blue Jeans mines 830
Cultus placer mine 116
Culver-Baer mine 345, 346
  meta-cinnabarite in 346
Culver claim 664
Cummings mine 830
  ranch magnesite 325
Cummins clay deposit 629
  silica sand deposit 633
Cunningham slate quarry 604
Curley mine 904
Cuyamaca Grant, gold on 647, 660
  Mountain 637, 641
Cyaniding concentrates 32, 23, 95
  direct at Black Oak mine 139

Daggett mine 843, 844
Daisy Bell mine 541
  mine 541
Dakin Company 802
Dane & Mitchell mine 27
Daniel Contracting Company 250, 253
Daniels marble deposit 198
Dannenbrink Estate 904, 912
  mine 904
Darrow mine 143
  slime concentrators 22
Daulton mine 538
Dave Savoy placer mine 387
Davis Creek oil well 411
  Flat mine 443
  mine 818, 846, 847
  quarry 294, 355
Deep Hole mine (*see* Eden Valley)
Dawson Pit quicksilver prospect 528
Deadhorse mine (*see* United Mines)
Dead River Channel mine 491
Deadshot springs 187
Deadwood district 882
Deakin & Taylor mine (*see* Old Spanish)
Decolorizing oils by fuller's earth 308, 309
De Dallis mine 764
Dedrick district 874

PAGE
Deep Channel mine 861
Deerfoot mine 75
Deer Hunter mine 491
  Lick springs 921, 922
Deerlodge mine 75
Deer Park district, gold in 647, 662–663
  lead in 668
  quicksilver mine (*see* Newhall)
Defender mine 27
Defiance and New Deal claims 665
Defiance district, copper in 665
  tin in 669
De La Mar, J. R. 764
Delilah Mining Co. 443
Delmatia mine 76
Del Monte mine 76, 143
Del Norte County 373–390
  black sands in 375–379
  building materials in 379
  chrome-iron in 380
  clay in 379, 380
  coal in 380
  copper in 374, 380–386
  Diamond Creek district in 384
  French Hill district in 385
  geology of 373–375
  gold in 386–390
    placers in 386–389
    quartz in 389–390
  iridum in 379
  osmium in 379
  platinum in 374, 375, 377, 379, 387, 388
  pottery clay in 380
  quicksilver in 390
  sandstone in 379
Delonagha hot springs 520
Delta claim 729
  Consolidated mine 784
  Mining Company 750, 788
  railroad 750
Demarest mine 76
Democrat springs 521
Densmore mine 143
Dennison springs (*see* Hazel)
Denny-Bar Company 834
Denny mine 846
Denver Gold & Silver Extraction Co. 490
  Mining Co. 841
Descanso district, gold in 647, 664
Description of Siskiyou County streams 811–814
Desert Springs and wells in Imperial County 741–742
  in San Diego County 720–722
  springs (*see* Kane)
Desilhorst, William, scoop dredge 777
Destinell mine (*see* Abbott)
Devil's Post Pile 531, 534, 559
Devonian rocks in Shasta County 758
  Trinity County 920
Dewey mine 648, 816, 831
Diablo Range 430, 455, 461, 471, 525
Diana mine 541
Diamond J. mine 57
Diamond mine 784

PAGE
Diamonds in Imperial County 740
Diatomaceous earth (*see* Infusorial)
Dickey ranch travertine 311
Dickinson quarry 355
Dick Morris mine 848
Digger Injun claim 230
Diller, J. S. 809, 925
Diltz mine 581
Dinsmore springs 224
Diorite, used for monumental stone 672
Discovery of gold in Kern County 481
Distillation percentages obtained from Humboldt County oils 411
Disturnell mine (*see* Abbott)
Dixie Queen mine 887
  Mining Co. 444
Dixon gravel pit 627
Doak manganese lease 622
Doctor Rock group 381, 386
  Young hydraulic mine 387
Dodge & Croker quarry (*see* Short Ranch)
  placer mine 444
Dodson & McQuig (*see* Dodson)
Dodson mine 76
Dog Creek district 775
Dollar springs 217
Dolling Gold Mining Co. 99
Dolly Varden mine 904
Donkey mine 765, 809
  zinc in 809
Donohue group 665
Doolittle mine 861
Dora Mining Co. 87
Dorsey Bros. gravel pit 627
Dos Cabezas mine 705
Dotta ranch chromite 319
Double Eagle and Little Quartz mine 831
  Standard claim 663
  mine 491
  Star claim 346
Douglas City mine 915
Douglas lithia claim 708
Downs mines 27
Doyle, Gill, Doyle & Co. 467
  mine 27
Draper mine 144
Dreadnot mine 492
Dredges, gold, in Calaveras County 54, 123–128
  in Merced County 606
    Shasta County 774, 777, 783
    Siskiyou County 813, 848, 864
    Stanislaus County 629
    Trinity County 874, 883, 919
  platinum recovered by 823
Dredging, gold 606, 628, 629
Dreisam mine 144
Drift mines (*see* under Gold)
Drilling, rate of, with calyx core drill 654
Drinkwater mine 904
Driver mine 904
Dry Creek mine 27
"Dry wash" placers 483, 507
Duck Bar placer mine 116
Duffield mine 144

PAGE
Duleek mine 144
Dulzura district, gold in 647, 664–665
Dumortierite in San Diego County 703
Duncan, J. P. Sons, salt works 713, 716
  springs 424
Dunlap, limestone near 452
Dunnigan mine 848
Duryea placer mine 117
Dutch mine 133, 135, 145, 146
Dutchess mine 76
Duxbury Point 241, 243, 274, 250
Dyer brickyard (*see* Sunset Brick Co.)

Eagle marble quarry 129
  mine 57, 656, 658
  -Shawmut mine 133, 146–147
Eakle, A. S. 636, 641, 642, 651, 669, 672, 673, 697, 698, 701
Early quartz mine 581
  Sunrise mine 492
Earthquake of 1906, quicksilver ore revealed by 345
  shaft damaged by, at Great Eastern mine 348
East Belt mining districts in Calaveras County 64, 65
  in Tuolumne County 135
  Belt Development Company 99, 109
  Fork district 874, 883
    group (*see* Oak Flat)
    mine 905
  Napa Mining Co. 182
  Side Canal Co. 477
Eastland-Gray Development Co. 117
Eastlick mine 823, 847
Eastman mine 905
Easton mine (*see* Shenandoah)
Eastwood prospect 444
Easy Bird mine 76
Echo mine (*see* Grey Eagle)
Eckert ranch magnesite (*see* Yordi)
Eclipse No. 1 mine 492
  placer mine 117
Economic mine 77
Eden Valley copper mine 418
Edna B. mine 785
  mine 57, 77
Edwards, Frank B., prospect 386
Eel River coal mine 417
  coal on 399, 415, 416, 418
Egleston, T. 227
Eida mine 77
Eight Oil Co., fuller's earth from 308, 481
El Banquero claim 733
El Cajon Grant, granite on 672
  quadrangle map 645
  Valley, mesa formation in 644
El Dorado & Eureka mines 773, 785
  claim 656, 658
  Creek Mining Co. 109
  mine 27
Electric power, cost of 63, 69, 79, 95, 109, 111
  power in Tuolumne County 132, 133
    plants in Fresno County 429, 430, 431, 432

PAGE
Electric power—Continued.
    Kern County 473, 474–475
    Madera County 535
    Mariposa County 569
    Shasta County 752, 816, 876, 893
  smelting of iron ore 751, 805–806
Eleda springs (*see* Fetters)
Elephant & China Hill hydraulic mines 27
  group 492
Elevada mine 656, 659
Elgin mine, ammonia in water of 183
  mineral water in 182
  natural gas at 188
  quicksilver concentration at 189
  sulphur in 189, 196
El Granito Mineral Springs Co. 718
Elizabeth mine 581
Eliza Jane mine (*see also* Bazinet) 444, 542
Eliza mine 831
Elk Creek mine 831, 861
Elkhorn hydraulic mine 387
Ella claim 656, 658
  group 493
Elliott mine 848, 917
  quarry (*see* McDonald)
  springs 224
Ellison Bros. marble 455
Ellston mine 493, 848
Ellwood, J. E., asbestos 432
El Paso Smelting Co. 733
El Portal Mining Co. 571
El Tesoro claim 733
El Toro claim 664
  spring 250
Emeralds in San Diego County 692
Emery group 117
Emigrant mine (*see* Truscott)
Emma mine 582
Empire Bar mine 861
  claim 656, 659
  Consolidated Quicksilver Mining Company 189, 229
  group 189
  mine (*see also* Plymouth) 3, 542, 785
Ems spring, Germany, analysis of 423
Encinitas Copper Co. 666
England springs (*see* Elliott)
Errington quarry 294
Englewood claim 729
Enoch mine 28
Enright mine (*see* Old Spanish)
Enterprise mine 539, 542, 859, 883, 887–888
Epidote in San Diego County 704
Erma Mining Co. 731
Erskine Creek, limestone on 516, 517
Escalle quarry 254
Escondido district, copper in 666
  gold in 647, 649–651
  mesa formation in 644
  mine 649, 650–651
  Town & Land Co. 650
Esmeralda mine 77, 692. 701, 707
Esperanza mine 785
  Vermont, marble like in Imperial County 735

PAGE
Espey mine ---- 849
Essonite (*see* Garnet)
Etna King mine ---- 65, 77, 78
  mine (*see* Aetna)
Eureka and Mississippi group ---- 148
  Brick & Tile Co. ---- 391, 392
  mine (copper) ---- 57, 879
  mine (gold) (see also El Dorado) ---- 4, 28, 148, 346, 888
    (Old Henry) ---- 78
    (placer) ---- 117
    (San Diego County) ---- 663
  tellurium mine ---- 786
Europa mine ---- 543
Evans Bar mine ---- 905
  mine ---- 862
Eveleth's mine (*see* Brown Bear)
Evening Star mine ---- 786
Everill mine ---- 862
Everlasting mine ---- 78
Excelsior mine (*see also* Knoxville) ---- 28, 78, 148, 493, 888
Exchequer power plant ---- 569
  rock quarry ---- 603
Expansion claim ---- 663
Experimental mine ---- 148
Exposed Treasure mine (*see* Mojave Consolidated)
Expositor and Summit claims ---- 437

Fachingen spring, Germany, analysis of ---- 423
Fagundez mine (*see also* Humpback) ---- 822
Faience tile ---- 686
Fairbanks, H. W. ---- 639, 642, 643, 645, 652, 676
Fair View group ---- 529
  mine ---- 493
Fairview mine ---- 888
  placer mine ---- 118
Fairville Quarry & Gravel Co. ---- 355
Fano mine, Riverside Co., kunzite in ---- 694
Farmers' Hope mine ---- 582
Farrall mine ---- 28
Farrington limestone deposit ---- 865, 867
Farris mine (quicksilver) ---- 187, 189
Far West Oil Co. ---- 411
Fauntleroy, W. A., gypsum deposits ---- 515
Feed water analysis ---- 459
Feldspar in Fresno County ---- 438
  San Diego County ---- 687
Feliciana mine ---- 582
Fellowcraft mine ---- 78
Felsite in San Diego County ---- 641, 676
  for crushed rock purposes ---- 676
Felt's springs ---- 409
Fender's ranch, mineral spring on ---- 182
Fenton-Sumption-Barnes Co. ---- 680, 682
Ferguson mine ---- 78
Fernando, Pliocene formations at ---- 639
Fetter's hot springs ---- 336
Fidelity mine ---- 78
Fifty-four Flat mine ---- 28
Fine Gold mine (*see also* Starbuck) 78, 118
Finian mine ---- 78
Finnigan mine ---- 65, 79

PAGE
Fioche Bros. quarry ---- 871
Fire brick ---- 4, 5, 10, 11
  clay ---- 687, 756
First National Copper Company ---- 761
First quartz location in Shasta Co. ---- 804
Fir Tree mine ---- 849
Fish Creek Mountains, gypsum deposits in ---- 738–740
Fish springs ---- 741
  Valley carbonated spring ---- 456
Five Oaks mine ---- 543
  Pines mine ---- 883, 890
    rich pockets in ---- 890
Flagstaff mine (*see* Eureka)
Flat Creek district ---- 773
Fleetwood & Nannie S. mine ---- 832
Flinn & Treacy quarry (*see* Hutchinson)
Floor construction of a circular brick kiln ---- 608
Florence M. mine (*see* Pure Gold Mining Co.)
  mine ---- 79, 148, 402, 786
Flying Dutchman mine (*see* Hoboken)
Fluorite ---- 703, 705
Flynn claims ---- 269
Focus mine ---- 28
Foote & Thompson mine (*see* Quartz Glen)
"Foothill Copper Belt" ---- 436, 538
  early shipments from ---- 538
Forbes quarry ---- 254
Ford and Foley mine ---- 915
  mine ---- 79
Forty-nine Flat mine ---- 28
  placer mine ---- 118
Forest Home mine ---- 14
Forget-Me-Not mine ---- 889
Forks of Salmon River mine ---- 849–850
Forney Glen gravel pit ---- 200
Fort Baker quarry ---- 254
  Barry (*see* Point Bonita)
  Goff mine ---- 850
  McDowell quarry ---- 254, 255
  Miller district ---- 440
    ranch pumice deposit ---- 470
  Rosecrans, San Diego granite in ---- 672
  Ross, iron deposit near ---- 322
Fortin Brick Co. (*see* McNear)
Fortuna brick yard ---- 391
Fortuna mine ---- 879
Foster Gold Mining Co. ---- 898
  granite quarry ---- 672, 673
Fountain claim ---- 656, 657
  Head mine ---- 789
Four Point mine ---- 789
Fourth of July claim ---- 660
Fouts springs ---- 184
  gold prospect at ---- 184
Fox, Hudson, Calhoun & Ford group 148
Fraction claim ---- 656, 660
Franciscan formations in San Diego County ---- 710
Francis claim (*see* Kings Quicksilver)
Franklin mine (*see also* Jewess; Milkmaid) ---- 786, 832
Frank Zaar copper mine ---- 383

PAGE
Freda mine 543
Free Coinage claim 663
Gold Mining & Milling Co. 726
Freight rates to Trinity County 878
Freitas quarry 315
Fremont Consolidated Mining Co. 29
Fremont mine 4, 28, 29
Fremont's party, discovery of gold by, in Kern County 481
French Bar placer mine 862
Gulch district 773, 775
mine (*see* American)
Hill chrome mines 380
district 385, 386
placer mine 387
platinum in 375, 387
John mine (*see* Squaw Gulch)
mine (*see* Ariel)
Syndicate of Paris 846
Fresno Brick & Tile Co. 435
Copper Mines Co. 437
Fresno County 429–470
abrasives in (*see* Volcanic Ash)
agricultural products in 432
area of 429
asbestos in 432
asphalt in 432, 433
brick and clay in 432, 433–435
chromite in 432, 435–436
coal in 432, 436
copper in 432, 436–438
diatomaceous earth in (*see* infusorial)
electric power plants in 429, 430, 431
feldspar in 438
fuller's earth in 439
gem materials in 432, 433
gold in 432, 440–451
granite in 465, 466, 467
graphite in 451
gypsum in 432, 451–452
infusorial earth in 452
irrigating canals in 430
lime and limestone in 430
Madera County formed from 531, 535
magnesite in 432, 452–455
marble in 455
mineral production of 432
resources of 432
water in 432, 456–459
natural gas in 432, 461
"nickel" in 461
petroleum in 432, 460–461
pumice in (*see* under Volcanic Ash)
quicksilver in 432, 462–464
silver in 432
stone industry in 432, 465–470
table of mineral production of 432
tin in 470
tungsten in 470
volcanic ash 470
water resources of 430
Fresno Enterprise mine (*see* Enterprise)
Flume & Lumber Co. 431

PAGE
Fresno—Continued.
Hot Springs 456
Magnesite Co. 454–455
River 535
Fricot group 80
Friday & Lowden group 765
copper mine 656, 666, 668, 670
Copper Mining Co. 656, 666–667
mineral paint in 668
nickel in ore of 666, 670
silver in ore of 667
Frinks springs 742
Fritz marble claims 736
Frugoli quarry 355
Fuel oil, cost of 464, 518, 544
Fuller's earth
bleaching tests on 208
in Fresno County 439
Kern County 474, 480–481
Kings County 526, 527
Solano County 307–309
Lovibond color scale tests on 208
Fuller, W. P. & Co. 630
Furnaces, electric, for smelting iron 806
Furnaceville copper district 757

Gabbro, orbicular 674–675
Gale, H. S. 231
Gambetta mine 539, 543–544
Gambrinus mine 786
Garberville, coal near 399
oil near 410
Garby's springs 424
Garden City Pottery Co. [illegible]
Gulch mine 905
placer 600
Gardiner claim 656, 659
Gardner and Deming mine 850
Bros. mine (*see* Red Hill)
quarry 295
Garfield mine 148, 787
Garibaldi mine 80
Garnets 249, 320
in Madera County 539
Marin County 249
San Diego County 692, 693, 703, 705, 706
Sonoma County 320, 321
Trinity County 922
on Spanish Peaks 539
white 539
Garnierite in Imperial County 732
Garnishee mine 493
Garvey brick yard 816
Gas (*see* Natural gas)
well records at Stockton 613–621
Gasoline from natural gas 461
Gasometer for natural gas 618
Gaston Hill placer mine 118
G. B. mine 493–494
Geary mine 582
Geeshan & Kellner mine 850
Gem deposits, geology of 694–695
Lepidolite mine 697, 708
materials in Fresno County 432, 439

PAGE

- Gem—Continued.
    - Kern County ---- 521
    - Madera County ---- 539
  - mine ---- 149, 905
- Gems (*see also* Jewelers' materials; *also* Ornamental stones; *also* Quartz crystals) ---- 320, 321, 432, 521, 539, 694
  - in San Diego County ---- 691–705
  - kinds of ---- 692–693
  - localities of ---- 692, 695–705
- Genelli ranch limestone ---- 128
- Geneva claim ---- 649
- Geological and topographical features of Siskiyou County ---- 811
  - Survey of California ---- 638, 639
- Geologic cross-section of Argonaut vein ---- 17
  - of Calaveras County ---- 67
  - description of Del Norte, Humboldt and Mendocino counties ---- 373–375
  - formations in southern California, table of ---- 639
  - maps of Imperial and San Diego counties ---- 645
- Geology of Amador County ---- 4, 12
    - copper belt ---- 12
    - gold belt ---- 4
  - Calaveras County ---- 56, 64–66
    - copper belts ---- 64–66
    - gold belts ---- 64–66
  - copper deposits in Shasta County ---- 757–758
  - Del Norte County ---- 373–375
  - gold districts in Shasta County ---- 775
  - Humboldt County ---- 373–375
  - Imperial County ---- 723–724
  - Kern County gold districts ---- 482–485
  - Mendocino County ---- 373–375
  - San Diego County ---- 639–645
  - Siskiyou County ---- 811, 820–825
  - Trinity County ---- 873, 874, 882
  - Tuolumne County ---- 134, 135–136
    - copper belt ---- 134
    - gold belts ---- 135, 136
- George Cook placer mine ---- 388
  - Washington placer claims ---- 387
- Gerabaldi mine ---- 80
- Gervanti mine ---- 80
- German Ridge mine ---- 80
- "Geyser" at Jones hot springs ---- 185
- Geysers (*see* The Geysers)
- Ghost mine ---- 80
- Giant Consolidated group ---- 765
- "Gibson Gusher" (oil), Colusa County ---- 188
- Gibson Oil Co. ---- 188
- Gilbertson mine (*see also* Deerfoot) ---- 80
- Gilkie mine (*see* Delilah)
- Gilliam Creek magnesite (*see* Ball; Healdsburg; Western Carbonic)
- Gilroy claim ---- 445
- Gilson mine, nickel in ---- 670
- Glacier group marble claims ---- 673
- Gladiator mine (*see* Old Blue)
- Gladding, McBean Co. ---- 318

PAGE

- Gladstone mine ---- 149, 773, 775, 787–788
  - section of ore shoots in ---- 787
- Glass sand ---- 625, 633, 688
- Glen Alpine spring ---- 224
  - Olive mine ---- 494
- Glencoe district ---- 64
  - mine ---- 81
- Glenn County ---- 197–201
  - brick clay in ---- 197
  - coal in ---- 197
  - copper in ---- 197
  - chrome in ---- 198
  - gold in ---- 198
  - granite in ---- 198
  - gravel in ---- 199
  - manganese in ---- 198
  - marble in ---- 198
  - mineral products of ---- 197
    - water in ---- 198
  - Mining Company ---- 798
  - natural gas in ---- 199
  - Oil & Coal Co. ---- 197
  - onyx marble (*see* Marble)
  - petroleum in ---- 199
  - quicksilver in ---- 199
  - salt springs in ---- 199
  - sand in ---- 199
  - sandstone in ---- 201
  - slate in ---- 199
  - soapstone in ---- 199
  - stone industry in ---- 199–201
- Globe mine ---- 882, 889–891
- Gold and silver in Colusa County ---- 175, 179, 181, 184, 189
  - Glenn County ---- 198
  - Lake County ---- 206
  - Napa County ---- 262, 269–271
  - Sonoma County ---- 321
  - Yolo County ---- 367
- Gold, assay value of ---- 540, 547
  - Ball mine ---- 882
  - Belt mine ---- 765
  - Chief of the Hills claim ---- 665
  - Cliff mine, Calaveras County 65, 66, 81
    - San Diego County ---- 649
  - Crown Consolidated mine ---- 494, 522
  - districts of Shasta County ---- 775
    - Siskiyou County ---- 821–825
    - Trinity County ---- 882–883
  - Dollar mine ---- 916
  - dredging ---- 774–777, 813, 848, 864, 874, 883, 918–919
    - costs ---- 606
    - in Calaveras County ---- 54, 123–128
    - Merced County ---- 606
    - Stanislaus County ---- 628, 629
  - drift mines ---- 860–864, 917
  - Drops claim ---- 656, 658
  - "dry washing" placers ---- 483, 507
  - -Galena mine ---- 82
  - geology of ---- 755, 811, 874, 882
  - gravels ---- 776, 822, 824, 843, 873, 883
  - ground sluicing for ---- 858–860, 916
  - Hill mine ---- 82, 833, 850
  - hydraulic mines ---- 844–858, 901–902

PAGE

- Gold—Continued.
  - in Amador County 4, 14–52
    - Calaveras County 54, 64–128
    - copper ores 758, 768, 770, 773
    - Del Norte County 386–390
      - placer mines 386–389
      - quartz mines 389–390
    - Fresno County 432, 440–451
    - Humboldt County 400–407
      - placer mines 401–407
      - quartz mines 400–401
    - Imperial County 724–732
    - Julian district 653–660
    - Kern County 474, 481–515
    - Madera County 537, 539–553
    - Mariposa County 575–600
      - lode mines 575–599
      - placer mines 600
    - Mendocino County 420
    - Merced County 606
    - San Diego County 646–665
    - Shasta County 773–804
    - Siskiyou County 812, 813, 814–816, 820–865
    - Stanislaus County 628, 629
    - Trinity County 875–876, 882–919
    - Tuolumne County 132, 133, 135–168
  - King group (*see* Gold Crown Consolidated)
    - mine 82, 656, 658
  - Lead mine 862
  - massive, in Morgan mine 97
  - Metal & Metal No. 2 group 545
  - Monster claim 656, 657
  - obtained from gravel washing plant 469
  - Peak mine 495
  - placer, assay value of 388, 401, 402, 403, 404, 405, 406, 407
    - mines (*see also* under various counties) 778, 843. 901–918
  - platinum with 374, 375, 377, 379, 387, 388, 869, 922
  - production of Amador County mines 4
  - quartz for jewelry 705
    - mines (*see* under various counties)
    - ores, smelting of, with copper 773
  - Queen mine 656, 658
  - Run mine 822
  - Ship gravel mine 167
  - Star claim 665, 667
  - State group 496
  - tungsten with 505, 507, 513, 522
  - value of per ounce, from placers 903, 905, 907, 909 910, 911, 912, 913, 914, 915, 917
- Golden Artery claim 665
  - Ball mine (*see* California Consolidated)
  - Chariot mine 656, 658
  - Chest mine 891
  - Cross mine 725, 726–728

PAGE

- Golden—**Continued.**
  - Cross
    - Mining & Milling Co. 726
  - Crown mine 727, 788
  - Eagle mine 832
  - Gate group 583
    - mine 82, 149
    - Orphanage springs (*see* Salvation Army)
    - Salt Co. 250
  - Gem group 656. 659
  - group 495
  - Jubilee mine 891–892
  - mine (*see* Brown Bear)
  - Nuggett mine (*see* Elliott)
  - Queen mine 727
  - Road mine 544
  - Rule mine (*see* Jumper)
  - Seal mine 832
  - Shamrock 656, 659
  - State Mining & Marble Co. 674, 733
  - Treasure mine (*see* Bellevue)
  - West mine 832
- Goler discovery of gold at 481, 483
- Golinsky group 766
- Good Hope group 82
    - mine 29, 496
    - Sunrise and Calaveras Queen group 82
  - Luck mine 496
- Goodyear, W. A. 639, 653, 668, 688
- Gordan mine 850
- Gordon springs 224
- Gorrill & Smith Oil Co. 188
- Goshen-Mars group 730
- Gospel mine 82
- Gossan 759, 770, 771
- Gottschalk mine 65, 83
- Gould mine 83
  - Mining Co. 100
- Grace group 497
- Grand Central claim 656, 659
  - -Sunshine-Standard group (*see* Balfron)
  - Grille spring, France, analysis of 423
  - Prize mine 29
- "Granite" black 465, 467
- Granite in Fresno County 465, 466, 467
  - in Glenn County 198
    - Madera County 531, 535, 537, 559–567
    - Marin County 242, 249
    - Mariposa County 600–601
    - San Diego County 641, 671–673
    - Sonoma County 321, 352, 357
    - Shasta County 804
    - Siskiyou County 865
    - Trinity County 875, 919
  - method of quarrying, at Raymond 563–565
  - mine (copper) 879
  - Mountain district, gold in 647, 660
  - sculptural carving in 561, 562, 563
- Grant Rock & Gravel Co. 469
- Grapevine camp, apatite near 717
  - district, gold in 647, 648

PAGE

- Graphic granite 703
- Graphite 54, 408
  - in Fresno County 451
  - Marin County 249
  - San Diego County 713
  - Sonoma County 321, 322
- Grasshopper mine (*see also* Banner) 83
- Graton, L. C. 809
- Gravel (*see also* under Stone Industry) 195, 199, 353, 355, 547
  - auriferous 373, 391, 776, 822, 824, 843, 873, 883
  - auriferous Tertiary, in San Diego County 652
  - channels, ancient, in Calaveras County 114
  - gold from 469
  - in Imperial County 736
  - on Stanislaus River 627, 629
  - platinum in 374, 391
  - screening of, for construction uses 467, 469
- Graves mine 917
- Graveyard and Vulture claims 445
- Gray Bros. quarry (*see* San Francisco Quarries Co.)
  - Eagle mine (*see also* Sunny Hill) 582, 789
  - mine 83
  - prospect 320
  - quarry 356
- Grayson mine (*see* Phoenix quicksilver)
- Greaser Gulch mine (*see* Daisy Bell)
- Great Divide mine 83
  - Eastern mine 342, 347, 348
  - Falls & Hope mines 788
  - Northern claim 348
  - Verde mine 766
  - Western Development Company 760
    - mine 83, 202, 231
- Greek mine (*see* Alpha & Omega)
- Greenback group 479
- Greenhorn district 858
  - Gulch mine (*see* Beaudry)
- Green Horn Mountain district 482
- Green mine 149
  - Mountain Copper group 572–573
    - district 482
    - mine 118
      - quartz crystals in 118
    - Tiger mine 823
- Greens Gulch mine 583
- Grey Eagle mine 497, 817, 818, 825
- Gribble mine (*see* Chapman & Fisher)
- Grider mine 851
- Griffin onyx quarries 869
- Griffith prospect (gold) 269
- Grigsby mine (*see* Palisade)
- Grizzly claim (copper) 320
  - Gulch mine 833
  - Medical springs 217
    - iodine at 217
- Gritton mine 29

PAGE

- Grossmont granite quarries 672, 673
- Grossularite (*see also* Garnet) 321
- Groveland district 136
- Grub Gulch district 535
- Guadaloupe mine 583
- Guadalupe claim 729
- Guest mine 583
- Guiffra mine 84
- Guillaume's spring (*see* Pope)
- Gumboat mine 833
- Gwin mine 54, 84, 85
- Gwynne mine (*see* Kern County Consolidated)
- Gypsite 515, 516
- Gypsum in Colusa County 179
  - Fresno County 432, 451–452
  - Imperial County 738–740
  - Kern County 474, 515–516
  - Kings County 526, 527
  - San Diego County 688

- Haas mine 906
- Hachinhama Lake (*see* borax and borax springs)
- Hackerman Bar mine (*see* Brown's Bar)
- Hager & Haas mine 906
- Hahn ochre deposit 691
- Halcyon mine 773, 789
- Haley mine 851
- Halstead mine (*see* Haley)
- Hamby mine 65, 85
- Hamilton brickyard 816
  - clay deposit (*see* Los Angeles Pottery Co.)
  - mine (*see* Lida)
  - W. R. 676
- Hammer mine 833
- Hancock mine 86
- Handy Andy mine (*see* Daisy)
  - J. O., gypsum analysis by 739
- Hang Bar mine 906
- Hanks, H. G. 639, 653
- Hanmore mine 545
- Hanna well 721
- Hansen mine 833
  - mineral paint deposit 276
- Happy Camp district 825
    - copper mines in 817
  - Home mine 851, 906
  - Jack claim 664
- Harbin Hot springs 207, 218
- Hardenburg mine 29
- Hardin quarry 356
- Harding mine (*see* Madroña)
- Hard Luck mine 389
- Haw quarry 392
- Hardscrabble mine 789, 822, 833, 851
- Hardtack mine 892
- Hard Times mine 892
- Hardy mine 86
- Harney quarry (*see* Melitta)
- Harper's mine 664
- Harper Well 741, 742

PAGE
Harrison Gulch district 775, 776
Harrison mine (see Mammoth; also Ruby)
Harris ranch quarry 295
Hartford mine 766
Hartman mine 118
Hart, T. G., iron claims 554
Harvard mine 133, 149–151
Harvey coal mine 11
  mine 915
Hassayampa claim 656, 659
Haskins mine 906
Hatchet Creek mine (see Haskins)
Hauling costs 454, 573
Haunted Bar mine 917
Havilah 471
  discovery of gold at 481
Hawkeye mine 545
Hawkins Bar mine 907
Hawkinsville district 858
Hawley Pulp & Paper Co. 454
Hay Fork Mining & Milling Co. 892
  Valley coal field 877
    limestone 920
Hayvilla sulphur spring 224
Hayward mine (see Eureka; also Allen)
Hazel Creek placers 777
  Dell mine 151
  Gold Mining Co. 787, 833
  mine 545, 825, 833
  springs 218
Headlight mine 892–893
Healdsburg Brick Co. 317
  Copper Co. (see Cornucopia)
  Lode mine 320
  Marble Co. 323, 325
  Paint Co. 321, 333
Hedges camp 726
Hedrick placer mine 118
Heiskell mine (see Fresno Copper)
Helen mine 226, 231, 232
Helvetia claim 656, 659
Henderson mine 907
  oil well 411
  ranch clay deposit 317
Hendrix & Howe claims 385
  Howe & McDonald group 385
Henrietta mine 152
Hercules mine (see also Delilah) 86, 693, 702
Herman mine 583
Heroult, electric smelting at 751, 805
Herron Oil Co. 188
Herr ranch, sandstone on 870
Hersey, O. H. 925
Hess, F. L. 325, 326, 454
Hetch-Hetchy Valley 132
Hexter placer mine 118, 119
Hickey mine 852
Hickory Jim claim 663
Hicks mine 834
Hidden Treasure mine 656, 657, 917
Hieatt, F. L., Brick Co. 685
High Fire Brick Co. (see Houze)

PAGE
"High grade" ore 810
High Grade mine 545
Highland mine 789, 822, 834
  springs 218
High Peak group 656, 659
Hilborn Bros. gas well 311
Hildreth district 535
  mine (see Volcano No. 1)
Hill quarry 356
Hillside claim 649
Himalaya mine 692, 701, 707
  Mining Co. 700
Hiriart gem claims 700
Hiriart Mountain gem mines 693, 698, 699, 708
Historical geology of San Diego Co. 640
History of Imperial County 723
  mining in Shasta County 774
    Trinity County 874
  San Diego County 637
Hite mine 583–584
Hites Cove, marble near 601
Hi You mine 852
Hoaglin oil well 412
Hoboken mine 545, 835
Hobo Springs (see Air Compressor)
Hodge limestone quarry 53
Hodge's Mountains, gold and copper in 732
Hodgson, J., tungsten claim 522
Hodson Mining Co. 113
Hoffman continuous kiln, for bricks 246, 247, 248
  for burning lime 806
  quarry 255
Hogue & Phillips claim 432
Holden chrome claims 755
Holland mine 86
Holmes mine (copper) 57
  mine (gold) 86
  ranch ochre 130
Holt & Gregg, brickyard 756
  lime kiln 807
  quarry 806
Homestake claim 656, 659, 697
  mine 87, 822, 835
Hood's hot springs 336
Hook & Ladder mine 907
Hooper Hill mine 852
  ranch iron deposit 322
Hoosier Hill mine 852
Hope claims (see Sonoma Cons.)
  mine (see also Great Falls) 152, 790
Hoppin Estate springs 219
Hornitos Gold Mining Co. 596
Horse Mountain 374
  copper district 394–399
  copper mine 394–397
Horseshoe and Homestake mine 907
Horseshoe mine (see Layman)
Horsetown 774, 776
Hotaling quarry 255
Hotel Calistoga hot spring 278
Hot springs (see also under Mineral Water) 747

- Hot Springs Mountain 637
- Hough springs 220
  - mineral paint near 207
- House Document No. 90 of 36th Congress 639
- Houze Brick & Cement Co. 300
- Howard claim 656, 657
  - springs 220
- Howell Mountain quarry 295
- Hubbard brick yard 686
- Hübnerite (*see* under Tungsten)
- Hubon, E. B. 653
- Huchting Ranch clay deposit 687
- Hudson & North Branch mines 87
- Huertevant mine (*see* Valdor)
- Huey Hill mine 852
- Hugert quarry 356
- Hughes Creek district 444, 449
- Hume-Bennett Lumber Co. 431
- Humboldt Bay 373
  - cement 393
  - Clay Manufacturing Co. 392
  - copper mine 397
- Humboldt County 391–414
  - black sands in 401
  - brick and tile in 391
  - building materials in 391–394
  - cement in 393
  - coal in 399, 400
  - copper in 394–399
  - geology of 373–375
  - gold in 391, 400–407
  - gold quartz in 400–401
  - gold placers in 401–407
  - graphite in 408
  - Horse Mountain district in 394–399
  - iron in 408
  - limestone in 393–394
  - Mattole district in 399
  - Mineral water in 408–410
  - natural gas in 408
  - ochre in 414
  - oil in 410–414
  - oil occurrences in, map of 413
  - petroleum in (*see* oil)
  - placers in (*see* gold)
  - platinum in 391, 401, 400, 404, 405, 406, 407
  - quarries in 392–393
  - sands in (*see* black sands)
- Humboldt Gas & Electric Co. 876
  - Mineral Water Co. 408
  - oils, distillation of 411
  - oil well 412
  - Placer Mining Company 912
- Humbug Creek district 814, 824
  - gravel mine 167
- Hummer mine 818
- Humpback mine 835
- Hungarian riffles in placer mining 600
- Hunter mine 893
  - R. D. gas wells 528
- Hunter's Luck claims 384
- Hurley prospect 348
- Hurley's ranch gas (*see* Rochester Oil Co.)
- Hurst & Eliason mine (*see* Steiner's Flat)
- Hutchinson ranch quarries 356
- "Hyacinth" in San Diego County 703
- Hyalite 13
- Hyampom Valley coal field 877
- Hyde mine (*see* Bellevue)
- Hydraulic Hill mine 907
  - limestone 302
- Hydraulic mines (*see also* under Gold) 810
- Hydro-electric power plants 429, 430, 431, 432, 473, 474, 475, 535, 569, 752, 816, 876

- Iagua mineral water 409
- Iconoclast mine 497
- Idaho Consolidated mines 87
- Idaho Jr. mine (*see* Excelsior)
- Idora mine 87, 380
- If I Can mine (*see* Stanislaus gravel)
- Igo district 775
- Illinois and Golden Bell claims 497
  - mine 87
- Imperial Copper Mining Co. 438
- Imperial County 723–743
  - bibliography on 743
  - brick in 737
  - cement materials in 736
  - clay in 737, 738
  - copper in 732
  - crushed stone in 736
  - gems in 740
  - geologic maps of 645
  - geology of 637–645, 723–724
  - gold in 724–732
  - gravel in 736
  - gypsum in 738–740
  - history of 637, 723
  - iron in 732
  - lead in 732
  - lime in 736
  - manganese in 732
  - marble in 733–736
  - mineral resources of 724
  - nickel in 732
  - nitre in 741
  - petroleum in 740
  - physiography of 723
  - salt in 741
  - sand in 736
  - separation of, from San Diego 637, 723
  - silver in 732
  - springs and wells 741–742
  - stone, crushed in 736
  - sulphur in 741
  - topographic maps of 645
  - water in 741–742
- Imperial Heights mine 852
  - mine 152
  - Reduction Co. 728
  - Valley 723
- Incorporated Eastern Company 837

PAGE
Incorporated Company of New York 818
  of San Francisco 837
Independence claim 662
  group 445
Independent Producers Transportation Co. 525
  Stone Co. 676–680, 683
Indian Bar mine 859
  Creek & Panwocket mine 907
    district 69
    Mining Co. 832
    Placer Mining Co. 903
  Metallic Red Paint mine 333
  Peak copper group 574
    district, copper claims in 575
  Queen mine 497
  springs (*see* Pope)
  Springs 477
Indians, placers worked by, in San Diego County 648
Inez mine 790
Infernal mine (*see* Eclipse)
Infusorial earth 805
Infusorial earth in Fresno County 452
  Napa County 262, 271
  Sonoma County 322
Ingelhardt, R., placer 445
Ingersoll mine 766
Ingleside mine 908
Ingomar mine 58
Inoceramus 303
Inoceramus, Whitneyi 642
Integral mine 924
Inyo mine (*see also* John L.) 835
Iodine in Colusa County 191
  Lake County 217
Ione City mine 14
Ione clays 5
  Coal and Iron Co. 5, 6, 12, 13
  copper mine 13
  Fire Brick Co. 3, 8, 10, 11
Iowa placer mine 445
Ira Hawk mine (*see* Contact)
Iridium in Del Norte County 379
Irma mine 30
Iron 52, 128, 408
  and manganese in Amador County 52
Iron in Imperial County 732
    Kern County 516
    Madera County 535, 554–558
    Napa County 271
    San Diego County 668
    Sonoma County 322
  Mask claim 664
  Mountain 532, 555, 557
    copper district 757
    mine 516, 759, 769
    No. 1 & 2 mines 516
    Wonder mine 480
  ore, electric smelting of 751, 805–806
    in Shasta Co. 750, 751, 805–806
    in Siskiyou County 811, 865
    in Trinity County 920
  Rock mine 87

PAGE
Ironsides mine 835
Irrigating canals in Fresno County 430
  Kern County 472
  Madera County 535
  Merced County 506
  San Joaquin County 623
  Stanislaus County 634
Isaac Newton mine 30
Isabel Dredging Co. 123, 126, 127
  mine 88, 893
Isham's spring 718
Island Mountain Consolidated mine 880, 881
Ivanhoe claim 656, 659
  mine 30
Ives, Lieut. J. C., expedition under 638
I. X. L. placer mine 119

Jackass Hill pocket mines 134
Jack Lowden mine 852
  Rabbit mine (*see* Golden group)
Jackson and Carter mine 881
  Baths 617
  gas wells 617
  mine (*see also* Buckeye Bar) 88
Jackson's soda springs (*see* Napa soda)
Jacob mine 908
Jacoby Creek, brick clay on 392
  limestone on 394
  quarry 392
Jacoby mine 893–894
Jacumba gem district 703
  springs 722
  warm springs near 720
"Jade Mine" 439
James Creek prospect (*see* Philadelphia)
James, George A., Co. 633
Jameson Lime Company 516–518
Jamestown Exploration Company 141
Jamul Grant, cement materials on 684
Janet claim 656, 660
Jasper 249, 674, 922
  Point quarry 602
Jayne, D. C., mines 730
Jeff Davis mine 498
Jennette mine 498
Jenny claim 446
Jerusalem mine 894
Jewel quarry 804
Jewelers' materials (*see also* Gems) 249, 320, 321
  in Marin County 249
Jewess prospect 233
J. I. C. mine 790
J. M. mine 545
Joe Ramus mine 853
Johnny mine 545
  Bull mine 545
John L. mine 546
  Miller mine 859
  W. Cates mine 546
Johnny Jumper placer mine 119

PAGE

- Johnson, A. H., gas well 528
  - and China Paul mine 823, 835
  - ranch mine 13
- Johnston-Oneida group 665
- Jolly Boy et al. group 651
- Jonathan and Keyes, discovery of gold by, at Keyesville 481
- Jones Hot Sulphur Springs 184
    - ammonia in 185
    - "geyser" at 185
  - mine, The 88
- Jordan quarry (*see* San Francisco Quarries Co.)
- José copper claim 605
- José Gulch mine 30
- Josephine group 498
  - mine (*see also* Buena Vista group) 88, 546, 584
  - T. G., group 498
- Joss mine 908
- Jubilee mine 790
- Julian district 647, 653–660, 666, 670
  - Carboniferous formations in 639
  - claims in 656–660
  - Consolidated Company 658
  - copper in 666, 667
  - geology of 654–655
  - gold in 647, 653–660
  - graphite in 713
  - Group formations 642
  - history of 653
  - map of 655
  - nickel in 666, 670
- Jumbo mine (*see* Ruby Basin)
- Jumper mine (Calaveras County; *see also* Mammoth) 88
  - mine (Tuolumne County) 133, 135, 152–153
- Jumping Jack mine 766
- Juniper group (copper) 269
- Junker ranch spring 341
- Jupiter mine (*see* German Ridge)
- Jurassic formations at San Luis 639
  - in San Diego County 665, 710
- Jursch quarry 295

- Kaiser Creek Diggings (*see* Dodge; also Inglehardt)
- K. and J. mine 88
- Kanaka mine 153
- Kane mine 585
  - spring 742
  - Springs 477, 521
- Kangaroo mine 836
- Kaolin (*see* also under Clays) 204, 244, 317, 318
  - in San Diego County 687, 688
- Karma mine 499
- Kate Gray mine 30
- Katherine mine 30
- Katie May mine 836
- King and Bayles mine (*see* King)
- Katrina mine 692, 700
- Kauss placer mine 388
  - platinum nuggets in 375

PAGE

- Kawana springs 337
- Kean ranch graphite 451
- Keeley claim (gold) 179
- Kellas quarry (*see* McNeill)
- Keeno & Joseph G. claims 446
- Kelly Estate fire clay deposit 687
- Kelly mine 30
- Kelseyville soda spring 224
- Keltz mine 88, 153
- Kenawyer group 438
- Kennedy Extension mine 34
  - -Milburn-Allerd claims 585
  - mine 4, 31–34
    - tailings storage at 4, 33, 34
- Kenross mine 88
- Kentuck S. mine 656, 659
- Kentucky House mine 88
- Kenyon mine (*see* Good Hope)
- Kern County 461, 471–524
  - antimony in 472, 474, 475–476
  - artesian belt of 472
  - asbestos in 476
  - asphalt in 474, 476
  - bibliography on 523
  - bituminous rock 474
  - borax and potash in 474, 477
  - brick and clay in 474, 477
  - Brick Company 478
  - cement in 478
  - climatic conditions in 472
  - coal in 474, 479
  - Consolidated Gold mines 499
  - copper in 474, 479–480
  - crushed rock in (*see also* Macadam) 474
  - fuller's earth in 474, 480–481
  - gems in (*see* Ornamental stones)
  - gold in 474, 475–515
    - districts 482–485
    - geology of 482–485
    - mines 486–515
  - gypsum in 474, 515–516
  - hydro-electric plants in 473, 474–475
  - irrigating canals in 472
  - iron in 516
  - Land Company 476
  - lime and limestone in 474, 479, 516–519
  - macadam in 519
  - magnesite in 519–520
  - marble in 520
  - mineral production of 474
    - resources of 475
    - springs in 520–521
  - mining districts in 482–485
  - natural gas in 474, 521
  - ornamental stones in 521
  - petroleum in 461, 471, 474, 522
  - potash in (*see* under Borax)
  - Rock quarry 519
  - rubble in 474
  - sandstone in 522
  - silver in 474
  - streams in 472
  - sulphur in 522

PAGE

- Kern County—Continued.
  - table of mineral production of 474
  - topography of 471
  - transportation facilities in 474
  - tungsten in 474, 505, 507, 513, 522
  - water resources of 472
- Kern Development Co. 487, 488, 491, 505, 511, 512
  - Development Syndicate quarry 522
  - Island 472
  - Lake 471
  - River 471, 472, 473
- Kernville hot springs 521
- Kessler, W. H., and W. R. Hamilton 676
- Kettleman Hills 525
  - fuller's earth in 439
  - petroleum in 528
- Keyes district 483
  - mine 483, 499
- Keyesville, discovery of gold at 481
  - Placer mine 500
- "Key Route" mole, rock for 252
- Keystone mine (*see also* Mohawk) 3, 4, 34–36
- Kidoo mine 88
- Kimball group of mines 36
- King George mine (*see* Minnesota)
  - mine (*see also* Golden West) 908
  - of All group 233
  - Solomon Consolidated Mines Co. 500
    - Gold Mining Co. 500
    - mine 836
- Kings County 525–530
  - brick in 526, 527
  - chromite in 525, 527
  - fuller's earth in 526, 527
  - gypsum in 526, 527
  - mineral paint in 526, 527
    - production of 526
    - resources of 525
  - natural gas in 526, 527–528
  - oil pipe lines in 525
  - petroleum in 525, 528
  - quicksilver in 526, 528–530
  - transportation facilities in 525
- Kings Quicksilver Mining Co. Ltd. 529–530
  - native mercury in 529
  - River 430, 525
    - quarry 467–468
- Kington quarry 315
- Kit Carson mine 790
- Klamath Hot Springs 869
  - River 810, 873
    - district 811–812
    - gold and platinum in gravels of 391
    - Gold Mining Co. 862
    - hydraulic mine 403
    - placer gold yield on 843
- Klein mine 853
- Klondike group 385
- Knob Gulch placers 776
- Knoxville mine 226, 287
  - mines 283
  - mines, production of 262

PAGE

- Knoxville—Continued.
  - petroleum in 226
  - quicksilver district 228
- Koehn springs 521
- Kolling magnesite 323, 324, 325, 326
- Kols wing dam mine 843
- Kosh Creek mine 767
- Kreyenhagen Hills 525
  - petroleum in 528
- Kriss-Kross mine 153
- Krohn, H. A., iron claims 554
- Kunz, Dr. Geo. F. 691, 692, 693, 700
- Kunzite 691, 698, 699, 700, 702, 706

- Labradorite 704
- La Condado claim 649
- Laconia mine 790
- La Cross mine 500
- Lady Belle Company 490, 498, 501, 503
  - mine 501
  - Ellen mine 540
  - Washington mine (*see* United Mines)
- La Grange Gold Dredging Co. 628, 629
  - hydraulic mine 874, 908
- La Guria mine 153
- Laguna Mountain 637
- Laidet ranch talc 131
- Lake County 202–241
  - barytes in 204
  - borax in 202, 203, 204, 234, 240
  - chromite in 204
  - clays in 204
  - coal in 205
  - copper in 205
  - gold and silver in 206
  - limestone in 206
  - macadam in 240
  - mineral paint in 207
    - products of 203
    - water in 207–225
  - natural gas in 225
  - onyx in 225
  - petroleum in 225
  - quicksilver in 226–240
  - stone industry in 240
  - sulphur in 202, 203, 234, 240
- Lake mine (*see also* Manhattan) 283
  - Mining Co. 288
  - Superior & Nevada Development Co. 164
- La Joya mine 288
- Lambert ranch, limestone on 179
- Lambing mine (*see* Arroyo Seco)
- Lambrecht ranch gas well 311
- Lamphere mine 153
- Lamphyre mine 89
- Lancaster ranch iron 322
- Landrum mine 585
- Lane, D. F. 636
- Lane's springs 424
- Langtry ranch copper 206
- Lapman mine 894
- Larribee Creek, coal on 399
- Larsen mine 909

PAGE

- Las Aguas Calientes 719
- Lassen Creek copper claims 396
  - Peak 747–750
- Last Chance mine 89, 894
  - Mining Co. 906
- Late sandstone quarry 130
- Lathrop gas well 612
  - hot sulphur spring 278
- Laura & North Star mines 153
- Laurel Creek mines (*see* Burton; Richter; Wakefield)
  - mine 894
- Laurent Bros. quarry (*see* Hutchinson)
- Lawndale quarry 357
- Lawson, A. C. 644, 676
- Lawsuit & Delia mines 540
- Layman mine 894
- Lazulite 704
- Lead 54, 132, 474, 534, 537, 558, 750
  - and silver in Madera County 558
  - in San Diego County 667
  - mine 154
- Le Clercq limestone quarry 128
- Lee soda spring 224
- Legal Tender mine 89
- Legioneer Gold Mining Co. 572
- Lehnberg quarry 672, 673
- Lenz quarry 295
- Lepidolite in San Diego County 693, 694, 698, 704, 706–708
- Levaggi Estate Co. 20, 36, 38
  - mine 36
- Levy, M. J. 308
- Lewis mine 154
- Lewiston district 874
- Liberty district 858
  - mine 790
- Lichau quarry 357
- Lida mine 501
- Lightner mine 54, 65, 66, 89, 90
- Lignite (*see also* under Coal) 11
- Lignus Asbestos mine (*see* Hanmore)
- Lime (*see also* limestone) 806
- Limestone, auriferous quartz veins in 822
  - in Amador County 52, 53
  - Calaveras County 54, 128, 129
  - Colusa County 179
  - Fresno County 452
  - Humboldt County 374, 393–394
  - Imperial County 736
  - Kern County 90–93
  - Lake County 206
  - Napa County 271
  - San Diego County 684–685
  - Shasta County 750, 758, 806
  - Siskiyou County 865–867
  - Solano County 309
  - Sonoma County 323
  - Trinity County 920
  - Tuolumne County 132, 168–169
  - Yolo County 368
- Lincoln Consolidated Mines Co. 36
  - mine 4
- Lindsay mine 90

PAGE

- Lingo mine 546
- Linscott quarry 296
- Lion mine (copper) 178
- Lithia, bismuth associated with 670
  - minerals in San Diego County 706–708
- Little Angel mine 501
  - Bear mine 585
  - Bonanza mine 501
  - Bonsa mine 836
  - Borax Lake 204
  - Bullion mine 546
  - Butte mine 502
  - Castle Creek chrome deposits 755
  - Hero mine 90
  - Illinois mine 37
  - Jackass Meadows 534
  - Joe mine 909
  - Klondike mine 401
  - Mary claim 726
  - May claim 446
  - Monitor mine (*see* Davis Flat)
    - mine 819
  - Queen mine (*see* Morrison & Carlock)
  - Three mine 692, 702
  - Wonder mine (*see* Ironsides)
- "Little Sulphur Bank" 238
- Live Oak mine 585
  - No. 1 and No. 2 mine 90
- Lloyd gravel mine 119
- Lockwood mine 90, 91
- Lodi mine 791
- Log Cabin Bar mine 909
- Log of Balboa oil well 711
  - Lo Tengo oil well 712
- Logs of Stockton gas wells 619
- London mine 586
- Lone Jack claim 663
  - Pine mine 881
  - Star mine 91
  - Willow group 37
- Longfellow mine 136, 154
- Long Gulch mine 909
  - Mary mine 586
  - Tom district 483
    - mine 483, 502
- Lookout group 348
  - mine 693
- Lopez mine 92
- Loraine mine 767
- Los Angeles Aqueduct, cement plant 478
  - mine 154
  - Pottery Co. 477, 478
- Los Guilicos warm springs 341
- Los Peñasquitos Grant, onyx on 674
- Lost Chord mine 791
- Lo Tengo Oil Co. 709
  - well 641, 710, 712
    - log of 712
- Lou Daggett mine (*see* Siskiyou River Bend)
- Louisa mine 586
- Louise mine 586
- Louisiana mine 154
- Louis mine 586

PAGE
Lounibos quarry 357
Lovelady ranch, mineral springs on 187
Lovely Rogers mine 587
Lovibond color scale for oil bleaching tests 308
Lowden mine (*see also* Jack Lowden) 853
Low Divide chrome mines 380
  mining district 381
Lowell, F. L. 371, 427, 569, 605, 607, 627
Lower Buckeye mine 909
  Dutton's Creek mine 909
  Mineral hot springs 457
Low Pocket mine 446
Luce, Joseph 718
Luce quarry 867
Lucille mine 37
Lucitta mine 204, 233
  kaolin at 204
Lucky Ben claim 658
  Bill mine 546
  Bob mine 862
  Boy mine 92, 155
    and Rosebud group 385
  Stone group 348
  Strike mine 836, 917
    and Effie Belle mine 910
Lumber transportation by "V" flume 431, 535, 536
Lumsen mine 155
Lynch quarry 357
Lyons spring 224
Lytton springs (*see also* Salvation Army) 334

Macadam (*see also* under Stone industry) 240
  in Lake County 203, 240
  Shasta County 807
  Siskiyou County 815, 867
  Sonoma County 352
Mace asbestos mine 5
Mackey ranch copper 135
Mackintosh oil well 412
Mack mine 136, 155, 692, 683, 700
MacParlane mine (*see* Woodbury)
Madden mine 656, 657
Madeira deposit (*see* under chrome; also magnesite)
Madera Canal & Irrigation Co. 535
  Consolidated Mining Co. 543
Madera County 429, 431, 432, 531–568
  asbestos in 538
  brick in 537, 538
  canal systems of 535
  cobalt (*see* Nickel)
  copper in 534, 537, 538
  crushed rock in (*see* under Stone industry)
  gems in 539
  geology of 531–535, 556
  gold in 535, 537, 539–553
  granite in (*see also* under Stone industry) 531, 535
  hydro-electric plants 535
  iron in 535, 554–558
PAGE
Madera County—Continued.
  irrigation canals in 535
  lead and silver in 534, 537, 558
  lumber flume in 535, 536
  mineral production of 537
  mineral water in 559
  molybdenite in 559
  nickel and cobalt in 535–537
  resources of 535
  Rock Crusher 562
  rubble in (*see* under Stone industry)
  silver in (*see also* under Lead)— 534, 535, 537
  soapstone in 559
  stone industry in 537, 539–567
    granite 537, 539–567
    sand and gravel 537, 567
  table of mineral production of 537
  talc in (*see* soapstone)
  tungsten in 568
  volcanic ash in 568
  water resources of 535
  zinc in 568
Madera Enterprise Mines & Land Co. 542
  Sugar Pine Co. 535, 536, 559
Madison mine 65, 81
  quarry 357
Mad Mule mine 791
  Ox mine 791
  River, coal on 399
Madroña mine 37
Maduro mine 792
Magdalena claim 664
"Magnesia" in Stanislaus County 629–630
Magnesite, analysis of, from Bissell 520
  analyses of 331, 332
  boulders in "Big Blue" beds 455
  in Fresno County 452–455
    Kern County 519–520
    Mendocino County 422
    Napa County 262, 271–275
    Sonoma County 324–333
  iron in, for steel furnaces 272, 331
  paint 273
  products of 272
  rotary kiln for calcining 328
  sedimentary deposit of 519
  shrinkage cracks 323, 324, 326, 330
  uses of 272–274, 453
Magnetite at The Minarets 558
Magnet mine 547
Mahoney mine (*see* Lincoln Cons.)
  ranch quarry 358
Maid of Erin group 648
Mailliard ranch deposits 247
Main & Fort Ritter mines 92
Malone mine 587
Maloney mine 92
Malloy mine (*see* Oregonian)
Malvina mine 587
Mammoth & Jumper mines 92
  copper mine 758, 767–769
    bag house at 768
    gold in 768

PAGE

- Mammoth Copper mine—Continued.
  - smelting practice at 768
  - top-slicing stoping method in 767
  - mine (*see also* Woodland; *also* Starlight) 38, 481, 502
  - Mining Co. 772
- M. & M. Mining Co. 447
- Manganese in Colusa County 180
  - Glenn County 198
  - Marin County 249
  - Merced County 606
  - Mendocino County 421
  - Napa County 276
  - San Diego County 668
  - San Joaquin County 621–622
  - Shasta County 807
  - Sonoma County 333
  - Stanislaus County 630, 631
  - Yolo County 368
  - ore, analyses of 421
- Mangante mine 155
- Manhattan mine 283, 288
- Manitou placer mine 119
- Mann copper mine 135
- Manuel prospect 269
  - quarry (*see also* Newman) 358
- Manzanita Bar mine 843
- Manzanita mine 179, 189
  - concentration of quicksilver at 189, 190, 2[illegible]7
  - gold in 179
  - limestone at 179
  - quicksilver in 189
  - sulphur in 196
- Maple Creek, coal on 399
  - mine 910
- Maple mine 894
- Maplesden mine (*see* Happy Home)
  - wing dam mine 843
- Map of Horse Mountain copper district 398
  - oil occurrences in Humboldt Co. 413
  - Sunnyside mine 450
- Maps of Imperial County 645
  - San Diego County 645
- "Marathon" tube mill 495
- Marble (*see also* Onyx marble)
  - in Amador County 4, 53
  - Calaveras County 129
  - Fresno County 455
  - Glenn County 198
  - Imperial County 733–736
  - Kern County 520
  - Mariposa County 601
  - Shasta County 807
  - Siskiyou County 867–868
  - Sonoma County 333
  - Trinity County 921
  - Tuolumne County 132, 169–172
  - Mountain 866, 867
  - "verde antique" 325
- Marianno iron mine 134
- Maricoma prospect 348
- Marin County 241–261
  - asphaltum and petroleum in 241–244
  - brick and clay in 242, 244–248

PAGE

- Marin County—Continued.
  - chrome in 247, 248
  - coal in 248
  - copper in 248
  - garnets in 249
  - granite in 242, 249
  - graphite in 249
  - jasper in 249
  - jewelers' materials in 249
  - manganese in 247, 249
  - mineral products of 241, 242
  - mineral water in 242, 249, 250
  - moonstones in 249
  - natural gas 250
  - petroleum (*see* asphaltum)
  - salt in 242, 250
  - stone industry in 242, 250–261
- Marin Rock Company 255
- Mariposa Commercial & Mining Co. 570, 575, 581, 583, 584, 586, 587, 590, 591, 593, 595, 598
- Mariposa County 569–604
  - asbestos in 571
  - barytes in 571
  - Big Tree grove in 569
  - copper in 572–575
  - cost of wood in 571
  - electric power plants in 569–570
  - fuel supply of 569
  - geology of 570
  - gold in 575–600
    - lode mines 575–600
    - placer mines 600
  - granite in 600
  - limestone in 570
  - marble in 601
  - meerschaum in 601
  - Mother Lode in 559, 560
  - phosphoretic zincblende in 602
  - power resources of 569
  - quicksilver in 602
  - rock quarries in 602–603
  - slate in 604
  - stone industry in 602–603
  - water resources of 569
  - Yosemite Valley in 569
- Mariposa Grant 569
  - copper vein on 575
  - Grove of Big Trees 569
  - mine 587
  - Mines & Development Co. 591
  - Mining & Milling Co. 597
- Markeson mine (*see* Bondo)
- Markham pottery 687
- Markley mine 38
- Mark West springs 337
- Markwood limestone quarry 128
- Maroni quarry (*see* Coutts; *also* Titania)
- Marrian and Goodale mine 837
- Marshall and Walters mine 769
- Martha mine 92
- Martinez smelter of Mountain Copper Co. 770
- Martin mine (*see* John L.)

PAGE

- Mary Harrison mine, 588
- Mascot group, 503
  - mine, 92, 155
- Mason & Thayer mine (*see* Craig)
  - Bar and China Creek mine (*see* Larson)
  - Ranch well, 721
- Masterson quarry, 804
- Matte, copper, 764, 768
- Matthai mines, 274
- Mattole mining district, 399
  - River, coal on, 399
- Maud & Happy Hooligan claims, 697
- Mayacmas quicksilver district, 228
- Mayata claim, 729
- May Day mine, 92
- Mayflower claim, 732
  - mine, 93, 155
- Maypole prospect, 233
- Mazeppa mine, 156
- McAdams Creek district, 813
- McAtee Bar mine, 910
- McAllister Company, 658
- McAlpine mine, 156
- McCain Springs, 742
- McCall mine, 792
- McCann placer mine, 119
- McCaskey, H. D., 227
- McClaughrey group, 837
- McClellan quarry (*see* McGilvray)
- McCloud River, 750, 757
- McClure mine, 769
  - Mountain, 531
- McConnell, Wm., claim, 843
- McCormick, M., Company, 144
- McCreary mine (*see* Lowden)
- McDaniels quarry, 867
- McDonald ranch quarries, 358
- McDuff & McMurty mine (*see* Contact)
- McEwan ranch spring, 341
- McFall mine, 704, 705
- McGilvray Raymond Granite Co., 561, 562–563
  - sandstone quarry, 191, 194, 195
    - mineral spring at, 187
  - Stone Co., 194, 195
- McGimpsey mine, 419
- McGuffey mine, 853
- McIntyre mine, 38
  - ranch spring, 224
- McKeen mine (*see* Cummings)
- McKenzie-Minturn mine, 547
- McKidney mine, 503
- McKinney Creek mine, 860
- McKinnon mine, 792
- McKnight Mining Co., 86
- McLaughlin and Pearl mine, 548
- McLaughlin, R. P., 427, 461, 531
- McMahon mine, 863
- McMurray and Hupp mine, 915
- McNamara limestone quarry, 128
- McNaughton's quarry (*see* Thomasson)
- McNeal mine (*see* Nordheimer)

PAGE

- McNear Brick Co., 244–247
  - quarries, 250, 256–258, 260, 358
- McNeill ranch quarry, 358
- McNutt Gulch oil well, 411
- McPherson ranch deposit (graphite), 276
- Meacham ranch quarry, 359
- Mead mine, 119
- Mebold mine, 588
- Mechanics mine, 38
  - Mining Co., 102
- Meckel mine, 910
- Medicinal properties of mineral waters, 208–210
- Meeker deposit (magnesite), 327
  - (ochre), 334
- Mee ranch quarry, 296
- Meerschaum in Mariposa County, 601
- Melani quarry, 359
- Melitta Stone quarries, 359
- Melones mine, 54, 65, 93–96
  - tellurides in, 93
- Melvin, Mountain Lily, Mary group, 547
- Mendenhall, W. C., 720, 741
- Mendocino County, 415–425
  - brick and tile in, 415
  - coal in, 415–418
  - copper in, 418–420
  - chrome iron in, 420
  - geology of, 373–375
  - gold in, 420
  - magnesite in, 422
  - manganese in, 421
  - mineral water in, 422–424
  - oil in, 424
  - quarries in, 425
- Merced County, 604–605
  - agriculture in, 604
  - asbestos in, 604
  - clay in, 604
  - copper in, 604
  - dredging in (*see* Gold)
  - gold in, 605
  - manganese in, 605
  - water resources of, 605
- Merced Gold Mining Co., 575, 586, 588, 594
  - River, 569, 570, 590
  - River Quartz Mines, 588
  - Stone Company, 602–603
- Mercer's Cave, 128
- Mercey hot springs, 457
- Mercy group, 462
- Mercury (*see* Quicksilver)
- Mercury Mining Co., 349
- Merrill, F. J. H., 635
- Mester mine, 96
- Mesa formations in San Diego County, 643–644
- Mesa Grande district, gold in, 647, 649
  - gem district, 700–702, 707
- Mesquite Placer diggings, 731
  - springs (*see* Kane)
  - well, 741, 742
- Metacinnabarite, 346, 347, 369

PAGE

- Metal Mountain, lead at 668
- Metals in San Diego County 646–671
- Mexican border district gold deposits 647, 665
  - mine 96, 462
  - onyx in San Diego County 674
- Mica in San Diego County 689
- Michigan-Salmon mine 853–854
- Midas claim 447
  - mine 774, 776, 792–793
  - Petroleum Co. 311
- Middle Bar group 38
  - Palisade 430
- Middletown prospect 223
- Midway mine 38
  - Mining & Milling Co. 598
- Miles asbestos deposit 755
- Milich mine 854
- Milkmaid and Franklin mines 773, 793–794
- Millenium mine 548
- Miller, John, mine 859
  - mine 863, 910
  - rock quarry 256
- Millerton 429
  - spring 457–458
    - analysis of water from 458
- Mills, early, in Shasta County 774
  - springs 216, 221
- Mill Site mine 663, 664
- Minaret iron deposit 129, 555–558
- Minarets (*see* The Minarets)
- Mina Rico mine 96
- Mineralite Manufacturing Co. 568
- Mineralized belt of high Sierras 436
- Mineral City mine 14
  - Mountain mine 769
  - paint in Colusa County 180, 181
    - Kings County 526, 527
    - Lake County 207
    - Napa County 276
    - San Diego County 668, 689–691
      - analyses of 690
    - Sonoma County 333, 334
    - Trinity County 921
  - production of Amador County 4
    - Calaveras County 54, 55
    - Colusa County 175, 176, 177
    - Fresno County 432
    - Glenn County 197
    - Kern County 474
    - Kings County 526
    - Lake County 202, 203
    - Madera County 537
    - Marin County 241, 242
    - Napa County 262
    - Shasta County 751
    - Siskiyou County 814–816, 843
    - Solano County 300
    - Sonoma County 316
    - Trinity County 875–876
    - Tuolumne County 132, 133
    - Yolo County 367, 368

PAGE

- Mineral—Continued.
  - resources of Shasta County 751
    - Siskiyou County 814
    - Trinity County 875
- "Mineral Soap" 688
- Mineral springs (*see* Mineral water)
  - water, analyses of 409, 423, 424
    - borax in 175, 187, 204, 215, 221
    - foreign, analyses of 423
    - in Calaveras County 130
      - Colusa County 175, 181–187
      - Fresno County 432, 456–459
      - Glenn County 198
      - Humboldt County 408–410
      - Kern County 520–521
      - Lake County 202, 203, 207–225
      - Marin County 242, 249, 250
      - Mendocino County 422–424
      - Napa County 262, 276–282
      - San Diego County 717–722
      - Shasta County 750, 808
      - Siskiyou County 864–865
      - Solano County 309, 310
      - Sonoma County 334–341
      - Trinity County 921–922
      - Yolo County 369
    - iodine in 191, 217
    - medicinal properties of 208–210
    - radioactivity of 184, 210
- Minersville district 883
- Mining and Scientific Press reference 729
  - claims in Julian district 656–660
  - conditions in Trinity County 874
    - Tuolumne County 133
  - industries of Shasta County 751
- Minnehaha mine 503
- Minnesota group 503
  - mine 794
- Minnie E. group 503
  - mine 96
- Minor, Isaac, quarry 393
- Miocene formations at Modelo and Puente 639
  - in Imperial County 640
    - Salton Basin 640
    - San Diego County 638, 639, 640
- Mirabel mine 202, 233
- Miracle mine 156
- Mission Rock Co. 681
  - Valley 643, 644
    - gravel and sand plants in 682
- Mississippi mine 136
- Missouri & Dolly Varden mine 119
  - claim 726
  - mine (*see* Culver-Baer)
- Mitchell mine (copper) 135
  - (gold) 97
- Moccasin and Golden Key group 156
- Mocking Bird mine 588
- Modelo, Miocene formations at 639
- Modesto Repressed Brick Co. 627–628
- Modoc mine 38, 895
- Moe claim 649

PAGE

- Moffatt quarry 296
- Mohawk mine 97
- Mohican mine 156
- Mojave Antimony Co. (*see* Antimony Consolidated)
  - Consolidated Gold Mines 504
  - Desert 471
    - salines in 477
  - Mining & Milling Co. 491
  - mining district 483
- Mokelumne Hill gravel channels 54
- Mok Hill Natural Mineral Water 130
  - analysis of 130
- Molybdenum in Madera County 559
  - San Diego County 668–669
- Monarch claim 649
  - mine 819, 837
  - Tungsten Gold Mining Co. 505, 522
- Monkey Creek placer mine 388
- Monk mine 910
- Mono Lake, geology southwest of 532
- Monolith cement plant 478
- Monolithic granite columns 563, 566
- Montana mine 97
- Monte Cristo group 588
- Monte de Oro 38
- Monterey County, glass sand from 625
  - shale 307
- Montezuma district, gold in 647, 648
  - Gold Mining Co. 648, 717
  - mine (*see* also Summit) 825, 863, 911
- Montmorillonite 688
- Monumental Consolidated mine 389, 390
  - district 384, 385
- Moody mine 157
- Moon mine 13
- Moonlight & Starlight mine 548
- Moonstones 249
- Moore mine 38
  - quarry 672
- Moosa Cañon gem district 702, 704
- Moose Head Water Power & Mining Co. 122
- Morgan mine 65, 97
  - massive gold in 97
- Mormon Bar, copper claims near 574
- Mormon mine 157
- Morning Star mine 548
- Morris mine 769, 916
- Morrison and Carlock mine 837
  - Gulch mine 910
- Morrow mine (*see* Bazinet)
- Morton and Bliss mine 794
- Morton spring (*see also* Roaring Soda) 224
- Moser mine 98
- Mother Lode 4, 54, 65, 133, 135
  - claim 729
  - district, a miniature of, at Julian 654
  - in Amador County 4
    - Calaveras County 54, 65
    - Mariposa County 569, 570
    - Tuolumne County 133, 135
- Mott, M., mine 843
- Mountain Belle claim 702
  - mine 589, 824

PAGE

- Mountain—Continued.
  - Boomer mine 895
  - Copper Co. 758, 769
    - mine 769
    - smelter of 770
  - King mine 38, 98, 590
  - Lily mine 702, 705
  - Lion claim 651
  - Mines Syndicate, Ltd. 770
  - Monarch mine 770
  - peaks in Fresno County 430
    - Madera County 531
  - springs 722
  - Summit Lime Co. 518
  - View mine (*see also* Brown & Smith Cons.; *also* Simmons)
    - mine 98, 548, 591
    - springs 410
- Mount Abbott 430
  - Buckingham group 589
  - Darwin 430
  - Gaines mine 569, 589
  - Godard, copper ore on 436
  - Humphreys 430
  - Jackson mine 347, 349
  - Jefferson mine 157
  - Lassen (*see* Lassen Peak)
  - Lyell 531
  - Nebo mine 98
  - Ophir mine 590–591
  - Pinchot 430
  - Pisgah quarry (*see* Petaluma Rock)
    - vineyard deposit 322
  - Pleasant mine 794
  - Powell 430
  - Queen 591
  - Raymond 532
    - iron deposits on 554
  - Sam mine (*see also* Lucitta)
    - kaolin at 204
  - St. Helena 262
  - Shasta 747, 810
    - Gold Mines Corporation 769
    - mine 794
  - Tamalpais 242
    - cemetery quarry 256
  - Timolus mine 98
    - claim 344
  - Vernon mine 157, 837
  - Whitney, San Diego County 651
  - Winchell 430
- Mud Springs mine 548
- Mule Creek mine 903
- Murphy mine 881
- Murray mine 795
- Mutt placer mine 119
- Mutual Life Insurance Co. 14
- Myrtle Creek Mining Co. 375
  - hydraulic mine 388
- Myrtledale farm spring 278

- Napa County 262–299
  - basalt in 299
  - bridges of 292, 293, 294
  - cement in 262–268

PAGE
Napa County—Continued.
chromite in 268
coal in 269
copper in 269
gold and silver in 262, 269–271
infusorial earth in 262, 271
iron in 271
lime and limestone in 262, 271
magnesite in 262, 271–275
manganese in 276
mineral paint in 276
products of 262
water in 262, 276–282
onyx marble in 282
paving blocks (*see* under Stone Industry)
petroleum in 282
quicksilver in 262, 283–292
rock plant 296
sand and gravel in (*see* under Stone Industry)
sandstone in (*see also* under Stone Industry) 262
serpentine in 299
silver in (*see* Gold and Silver)
steatite in 299
stone industry 262, 247–299
volcanic ash in 299
volcanic tuff in (*see also* various quarries under Stone Industry) 299
Napa Consolidated (*see* Oat Hill)
Copper Co. 269
prospect 349
Rock spring (*see* Priest's)
Sandstone Co. 297
Soda Springs 262, 278–280
Valley Mineral Water Co. (*see* Priest's spring)
Vichy spring 280
Napoleon Consolidated mine (*see* Santa Ana)
mine 58, 485
Nash mine 911
Nassau Copper Co. 56, 59
analysis of ores of 59
mine 58, 59
National Geographic Magazine, reference 724
Native Copper mine 418
Gem Mining Co. 701
quicksilver (*see* under Quicksilver)
Son mine 854
Natomas Consolidated of California 360
Natura Company 602
Natural gas, analyses of 611, 614–618
gasoline from 461
in Abbott mine 229
Colusa County 187
Fresno County 432, 458, 561
Humboldt County 408
Kern County 474, 521
Kings County 526, 528–529
Lake County 225
Marin County 250

PAGE
Natural gas in—Continued.
San Joaquin County 607, 610–621
Solano County 310, 311
Sonoma County 341
use of, in cement works laboratory 306, 310
Naylor, J. G. 636
-Vanderberg claims 700
Neenach, marble near 520
Negunda mine 917
Neill's hot springs 521
Nellie and Annie mine 795
Dent mine 482, 505
and Content group 505
Nels Christensen hydraulic mine 388
Nelson mine 98
rock plant 682
Ne Plus Ultra mine (*see* Daulton)
Nevada & California railroad 474
Mineral Extraction Co. 592
Never-Sweat mine 157
New Albany Consolidated mines 39
mine (*see also* United Mines) 134
Citizen mine 549
Elgin Quicksilver Mining Co. 189
England mine (*see* Ruby)
Idria mine, quicksilver furnace at 228
London mine (*see* Lucille)
Phoenix Mining Co. 230
Providence Gold Mining Co. 159
River placer mine 911
York and Skylark mines 795
York mine 39, 98
Newhall quicksilver mine 632
Newman Clay Co. 7, 8, 9
quarries 297, 298
spring 221
Newton mine 12, 13
Niagara mine 795
Niccolite 670
Nickel and cobalt in Madera County 559
associated with copper 666, 670, 819
in Fresno County 439, 461
Friday, copper mine 666, 670
Imperial County 732
San Diego County 666–667, 670
ore, analyses of 666
Nigger Boy mine 837
Hill mine 911
Nightingale mine (*see* Siskiyou mine)
"Nile green" tourmaline 703
Nip and Tuck claim 656, 658
"Nipicuro" water, analysis of 922
Nitre in Imperial County 741
Nixon mine 98
Noble Electric Steel Co. 806–807
mines 667
Noble's springs 216
Noce placer mine 120
Non-metallic minerals in San Diego County 671–722
Nonpareil mine 157, 881, 895
Nordheimer mine 854
Nordhoff, Walter 636
Norris quarry (*see* Bacigalupi)

PAGE
North Branch mine (*see* Hudson)
  Chariot mine 656, 658
  Fork district 874
  Fork Mining District 533, 558, 568
  Hill, South Hill, Whiskey Hill et al. group 120
  Hubbard mine 656, 658
  Palisade 430
  Star claim 198, 659, 665
  Star mine 39, 98, 99, 120, 656, 659, 796, 895
Northern California Dredge Co. 864
  California Power Co. 752, 759, 760, 770, 772, 775, 783, 788, 790, 791, 793, 798, 803, 806, 807
  Light prospect 289
  Natural Gas Co. 614, 616
Northey, G. V. 190, 227
Northwestern Pacific R. R. Co., rubble for 256
  sand and gravel pits of 360
Norton ranch magnesite 327
Norwegian mine 157
Norwich mine 99
Novella mine 99
Number Five mine 592
  One mine 591–592
Nuvida mineral spring 718
Nye ranch, marble on 198
  quicksilver on 199
  sandstone on 201

Oak Bar district 858
  Flat & East Fork group 388
  Hill copper mine 135
Oakdale irrigation district 623, 634
  wells in 634
Oakland mine (*see* Culver-Baer)
Oakville mine (*see* Bella Union)
Oat Hill mine 228, 262, 289–291, 312
  concentration at 56, 118, 119
  retorting concentrates at 117, 118
O'Brien ranch spring 337
Occidental and Healdsburg group 349
  ochre deposit 334
Ohms springs 337
Ochre (*see also* Mineral Paint) 130, 414
  in San Diego County 691
  Stanislaus County 630, 632
O'Connell Blue Gravel mine 120
  mine 911
O'Donnell mine 157, 860
O'Donnell's sulphur spring 337
Ogle copper mine 419
O'Hara mine 157
Ohio group 838
  mine 99, 770
Oil (*see* also under Petroleum)
  for fuel 431
  fuel, cost of 464, 518, 544
  in Humboldt County 373, 374, 410–414
    Mendocino County 374, 424–425
    quicksilver mines 226, 312
  loading rack 460

PAGE
Oil—Continued.
  occurrences in Humboldt County, map of 413
  pipe lines 432
  seepages 412, 413
  wells, number producing at Coalinga 461
"Oil spring" 187
Oils, bleaching of, by fuller's earth 308, 309
O.K. mine 158
Old Blue mine 549
  Chapman prospect 349
  Cowboy mine 505
  Crow claims 385
  Diggings district 773
  Dominion mine 158
  Henry mine (*see* Eureka)
  Highland mine (*see* Highland) 838
  Indian mine 838
  Jackson mine (see Fleetwood) 832
  Keyes mine (*see* Keyes)
  McKinney mine 99
  Spanish mine 796
  Tuolumne mine 158
  Vet and Eclipse mine 838
  Washington mine 99
  Wilcox mine 593
Oleson quarry (*see* Hutchinson)
Olive mine 796
Olla claim 699
Olsen quarry (*see* Zollner)
Omega mine 158
Oneida mine 4, 39
O'Neill & Abbott quarry 192
Onley Creek 776
Ono district 776
Onyx marble in Colusa County 188
  Lake County 225
  Napa County 282
  San Diego County 674
  Solano County 310, 311
Opals 321, 521
Open cut mining at Yellow Aster mine 513
Operating costs (*see also* Costs, various) 496, 499, 501, 503, 514, 551, 573, 606, 761, 762, 784, 793, 846, 865, 888, 893, 906. 911, 912
Ophir mine 158, 506
Ora Anna mine 390
Orange peel bucket excavator 302
Orbicular gabbro 674–675
  analyses of 675
Orcutt hydraulic mine 403
Oregon Consolidated mine 770
  Gulch 776, 920
Oregonian group 838
Orejana Mining Co. 476, 489, 509, 513
Orestimba quicksilver mine (*see* Phoenix)
Original mine 593
Oriental copper claim 184
  mine 187, 189
Oriflamme district, gold in 647, 660

PAGE
Original Amador mine 39, 40
White Sulphur springs 280
Oriole mine 99, 896
Orleans Bar mine 403
Ornamental stones (*see also* Gem Materials) 521, 869, 922
Oro Blanco Mining Co. 656, 659
Del Norte Company 375–379
plant of, for electrolytic recovery of gold and platinum 375–379
Fino district 823
mine (*see also* Pilot) 506, 649, 651, 796
Nos. 1 and 2 claims 447
Grande mine 838, 896
-Plata mine 100
Vista mine 796
Water, Light & Power Co. 123, 127, 128
Oromiento mine 100
Orra Rica mine 593
Orr's mineral springs 423–424
Osmium in Del Norte County 379
Ostrea vespertina, Con. 640
Oswald mine (*see* Big East Fork)
Otay Oil Co. 709
oil well 642, 709, 710, 713
River Valley, gravel from 676, 680, 681
Ouvarovite (*see also* Garnet) 922
Overall-Stickle Mining Co. 72
Overton mine 822, 838
ranch coal 248
Owen's mine 655, 656, 660
Oxide claim 663
Ozark mine 896
Ozocerite, associated with quicksilver 344

Pacific Coast Asbestos Co. 755
Electric Railroad Co. 672, 673
Engineering & Construction Co. 392
Gas & Electric Co. 155, 569, 623–624
group 349
Improvement Co. 5, 12, 16, 868
Laguna Oil Co. 710
Light & Power Co. 429
430, 455, 473, 474, 479, 487, 503
Lime & Plaster Co. 168
mine (*see* also Plymouth) 3
Ocean, salt from waters of 713
Paint Products Co. 690
Portland Cement Co. 301, 302–307, 309
crude oil used in plant of 305
use of natural gas in laboratory of 306, 310
Quicksilver Co. 462, 463, 464
cost of oil fuel at 464
furnace of 462, 463
slate quarry 604
Padlock claim 656, 658
Padre y Madre group 729
Paine mine 860
PAGE
Painter mine 438
Paint M. & M. Co. 276
Pala, bismuth at 670
Chief Gem Mining Co. 698
mine 691, 693, 694, 696–699, 707
lithia minerals in 707, 708
Mountain 696
district gem deposits 695
King claim 697
Mountain 696
"Palagonite" 689
Industrial Mining Co. 689
Palisade mine 270
Palm springs 721
Palomar Mountain 637
Panama-American Oil Co. 710
Paoli mine 452
Paonazza, Italian, marble like, in Imperial County 734
Paradise Flat mine 863
mine 549
Paragon group 100
placer mine 120
Paragonite 689
Paramore springs 224
Parker, H. L. 752
Peak 533
quarry 868
Parsons. Chas. L. 307
Pasadena claim 665, 729
Patent Brick Co. 247
Patterson "magnesia" near 629
manganese near 630
mine 158
silica near 613
Pattison spring 921
Patton mine 549
Paving blocks (*see also* under Stone Industry) 351, 352
in San Diego County 672
production of, in Sonoma County 352
Paymaster mine 549, 732
Peaks, relation of auriferous veins to 821
Pearce copper mine (*see* Green Mountain; also San José)
Pearch Creek, gold quartz on 401
hydraulic mine 404
Pearl mine (*see* Ruby)
Pebbles for tube mill, cost of 515
Peck mine (*see* Afterthought)
Pedro mine (*see* Stonewall)
Pedroncelli quarry 360
Peek ranch mine 100
Peerless mine (*see* Ingersoll)
Pegmatite dikes, gems in 694–695, 700
graphic granite in 703
Peña Blanca mines 159
Peñon Blanco mine (*see also* Orra Rica) 569
Peñavita mine 41
Penn copper mine 59–62
blast furnace charge at 61
Pennsylvania Chemical Co. 625

PAGE

- Peridot in Imperial County 740
- Perry, C. N., map of Imperial County by 645
- Petaluma and Santa Rosa Electric Ry. Co. (*see* Stony Point)
  - Home Oil Co. 342
  - Municipal Rock Crusher 360, 361
    - costs at 361
  - Oil and Development Co. 341
  - road metal from 425
  - Rock quarry 361, 362
- Peters, Frank, gas well 408
- Petticoat mine 100
- Petroleum (*see also* under Oil)
  - in Colusa County 188
    - Fresno County 432, 460, 461
    - Glenn County 199
    - Imperial County 740
    - Kern County 461, 471, 474, 522
    - Kings County 525, 528
    - Knoxville quicksilver mine 226
    - Lake County 225
    - Marin County 241, 243, 244
    - Napa County 282
    - quicksilver mines 226, 312
    - San Diego County 708–713
    - Solano County 311
    - Sonoma County 341, 342
  - natural gas accompanying 461
- Petrolia, oil near 410
- Peyton Chemical Co. 64, 420
- Phelan quarry 297
- Philadelphia mine 41
  - prospect 291
- Phillips mine 819
  - soda spring 281
- Phoenix Development Co. 507
  - mine (*see* Aetna)
  - quicksilver group 632–633
- Phosphates in San Diego County 717
- Phosphoretic zincblende 602
- Physiography of Imperial County 723
  - of San Diego County 637–638
- Picacho Basin Co. 730
  - group 730
  - Hills, gold in 725, 729–732
- Pickett quarry 297
- Pickwick mine 506
- Pierce & Company 493
- Pierson & Co. mine 843
  - coal mine 319
  - springs (*see* Saratoga)
- Pieta mine 419
- Piety Hill mine (*see* Hardscrabble)
- Pietzoli, Lorenz, quarry 362
- Pigeon mine 41
- Pilot Knob mine 839
  - mine 100
- Pine Flat quicksilver district 342
  - Grove mine 844, 854
  - Tree mine 485, 506, 593
  - Valley district, gold in 647, 663–664
- Pioneer mine (*see also* Socrates) 342
- Pinite 689

PAGE

- Pinmore mine 507
- Pioneer Chief mine 101
  - district 483
  - mine 41
  - Reduction Co. 16
- Pipe lines for oil transportation 432
- Pit River 750, 757
  - floating mine timbers down 763
  - mine 770
- Piute Consolidated mine 506
- Placer gold, assay value of 903, 905, 907, 909, 910, 911, 912, 913, 914, 915, 917
  - Gold Company 507, 522
  - mines (*see* under Gold)
    - yield of, in Siskiyou County 843
- Platinum in Calaveras County 54, 55
  - in Del Norte County 374, 375, 377, 379, 387, 388
    - Humboldt County 391, 401, 402, 404, 405, 406, 407
    - Siskiyou County 811, 814, 815, 846, 869
    - Trinity County 875–876, 902, 903, 905, 907, 909, 911, 912, 913, 915, 917, 923–924
  - nuggets of 175
  - plant for electric recovery of 177
- Plaza limestone quarry 129
- Pleasant View mine (*see* Apache; *also* King Solomon Gold Mining Co.)
- Pliocene formations at Fernando 639
- Plutus mine 819
- Plymouth Consolidated Gold Mines Co. 3, 4, 41–43
  - mill flow sheet of 44
  - mine 4, 41
  - -Eureka mine 43
  - Rock mine 101
- Pocahontas copper mine 573
  - mine 44
- Poe claim (copper) 206
- Poison Camp coal field 878
- Point Arena, bituminous sandstones at 425
  - Bonita quarry 256
  - Loma claim 656, 657
- Polar Bear mine 507, 819
- Polkingham mine 771
- Pollasky district 440
- Pontiac group (*see* Socrates)
- Poorman claim 656, 657
  - mine (*see* Rand)
- Pope mineral spring 281
  - Valley deposit 274
    - mines 283
- Popejoy mine 771
- Portuguese Company 843
  - mine 855
- Posey Hill mine 45
- Poso Creek 471, 472
- Post and Wilson mine 912
- Potash in Kern County 474, 477
- Potilla mine 911
- Potosi mine 569, 594, 796
- Potter & Humboldt mine 912

PAGE

- Pottery clay (*see also* under Clay) 317, 380, 477, 478, 605, 607
    - materials in San Diego County 686–688
- Poverty Flat mine 912
- Power (*see also* Electric 431
    - cost of 606
    - plants (*see* Electric)
- Practical Investment Co. 512
- Preckel mine (*see* Hooper Hill)
- Premier Investment Co. 689
- President mine 507
- Preston, E. B. 533, 534
    - Peak mine 386, 819
- Price mine 101
    - T. G. placer 447
- Pride of the West mine 656, 658
- Priest mine 275
- Priest's Hill 135
    - soda spring 281
- Primmer artificial stone plant 567
- Prince mine 101
- Princess mine 797
- Princeton mine 594, 595
- Prim and Dougherty chrome claims 755
- Producer mine (*see* Ellston)
- Producers Transportation Co. 432
- Product Development Co. 9, 10
    - clay washing plant of 9
- Prospect Hill mine 839
    - mine 693, 702
- Providence claim 448
    - mine (*see also* Golden Road) 134, 159, 447, 839
- Provident Mining Co. 486
- Puente, Miocene formations at 639
- Puerto Fino mine 159
- Pumice (*see* under Volcanic Ash)
- Pumping plants for irrigation 431
- Punch-bowl gravel mine 167
- Purdy group 101
- Pure Gold mine (*see* New Citizen)
    - Mining Co. 549
- Purrington quarry 362
- Putah Creek quarry 390
- Pyramid mine 508
- Pyrites 750
- Pyrope (*see* Garnet)

- Quail Hill copper mine 62
    - quartz claims 595
- Quaker City Bank 730
    - mine 101
- Quarries in Humboldt County 392–393
    - Mendocino County 425
- Quarrying methods at Kings River quarry 467, 468
    - at Raymond granite quarry 563–565
- Queen Esther mine 504
- Quartz crystals 54, 118
    - deposit 633
    - Glen mine 101
    - gold bearing, used for jewelry 705
    - Gulch mine 855
    - Hill mine 783, 824, 839
    - in San Diego County 687, 705

PAGE

- Quartz—Continued.
    - mills in Shasta County 774
    - Mountain mine 5, 49
    - prospect on Pearch Creek 401
    - sand for glass making 4, 10, 688
    - Valley district 822
- Quicksilver, bibliography on 229
    - bitumen with 344, 348
    - concentrates, use of air in retorting 285, 289
    - concentration of 189, 190, 227, 228, 240, 283, 284, 285, 290, 312
    - furnaces 462, 463, 529
    - gold with 189
    - in Colusa County 176, 189, 190, 191
        - Del Norte County 390
        - Fresno County 442, 456–464
        - Kings County 526, 528–530
        - Lake County 202, 203, 226–240
        - Mariposa County 602
        - Napa County 262, 283–292
        - Siskiyou County 870
        - Solano County 300, 311, 312
        - Sonoma County 316, 342–351
        - Trinity County 875–876, 923–924
        - Yolo County 368, 369
    - native, at Calistoga hot springs 227
        - in Sonoma County 342, 344, 346, 347, 349, 350
    - ozocerite with 344
    - petroleum with 226, 312
    - prices 226
    - tariff on imports of 227
    - uses of 226, 227
- Quigley soda springs 224
- Quimby mine 881, 896, 912
    - O. P. gas well 528
- Quinn ranch, dredging on 798

- Ragesdale mine 549
- Railroad & Mountain Morensis mine 912
- Railroad survey reports 638
- Railroads (*see also* under Transportation) 3, 54, 133
- Rainbow group 396, 399
    - mine 508, 819, 917
- Raindrop claim 656, 657
- Rainfall in San Diego County 717
- Ralston mine 897
- Ramis mine (*see* Dick Morris)
- Ramona gem district 702
    - Oil Co. 341, 342
- Ramus mine (*see* Joe Ramus; *also* Sylvester Ramus)
- Rancheria mine 45
- Ranchita mine 656, 658
- Rand district 481, 483
    - tungsten in 522
    - mine 101, 508
- Randsburg Coal Co. 479
    - Water Co. 507
- Rainier mine 120
- Ransome-Crummy Company 603
- Rappahannock mine 159
- Rates of drilling with calyx core drill 554

PAGE

- Rathbun prospect 190
- Rathgeb mine 102
- Rattlesnake mine 228, 349
  - native quicksilver in 228, 342, 349
- Rawhide mine 133, 135, 159–160, 508
  - No. 2 mine 160
- Ray mine 897
- Raymond granite 465, 559–567, 600
  - Granite Company 563–567
  - Land Company (*see* Short Ranch)
  - R. W. 647, 653, 809
- Rayo mine 476
- Reading clay deposit 756
- Reading, origin of name 774
- Ready Relief mine 648, 654, 656, 657, 705
- Recompense mine 102
- Recorder mine 595
- Red Buck mine 419
  - Cap Creek copper mines 395, 399
    - gold on 400
  - Cap mine 400
  - Cloud mine (*see also* Brown & Smith Cons.) 45, 269
    - quicksilver (*see* Pacific)
  - Dog custom mill 485. 500, 503, 504, 510, 513
  - Elephant prospect 234
  - Flat mine 912
  - Gold mine 102
  - Hill claim 649
    - group 509
    - mine (*see also* Michigan-Salmon; Russian Hill; Bartel Jacobs) 509, 797, 839
  - Jacket mine 160
  - Meadows hot sulphur springs 559
  - Mountain group 419
  - Point mine 915
  - Porphyry mine 404
  - Slide deposits (*see* Sonoma Magnesite Co.)
  - Tape mine 45
  - Wing spring (*see* Spiers)
- Redington mine (*see also* Knoxville) 283
- Redlands King mine 699
- Redman group 657
- Redrock group 651
- Redwings mine 699
- Redwood Copper Queen mine 419–420
- Reed and Hillary mine (*see* Lone Star)
  - claim 595
  - gravel mine 121
  - mine 369
  - oil well 412
- Reeder group 840
- Reid mine 797
- Reilly cement blocks 318
- Reindeer mine 897
- Remilliard Brick Co. 248
- Republican mine 160
- Revel mine 595
- Reward mine 45
- Rex mine (*see* Canary)
- Rex Plaster Co. 520

PAGE

- Reynolds clay deposit 817
  - ranch quarry 362
- Rhetta mine (*see* Amador King)
- Rhodes, L. H., and Brown, G. E., tungsten deposit 470
- Rice district, gold in 647, 648
  - group 648
- Richardson springs (*see* Grizzly)
- Richman Company 837
- Richmond claim 657, 658
- Richter, H., placer 448
- Rico claim 448
- Ridgeway Estate Co. 730
  - mine 897
- Right Bower mine (*see* Great Western)
- Rigoni quarry 363
- Riley & Bliss (*see* Morton & Bliss)
- Rincon del Diablo grant 650
- Rincon gem district 700
- Rising Star mine 121
  - Sun mine 161
- Ritter, Dr. Wm. E. 709
  - mine 102
  - Mountain 531
- Riverside, County, kunzite in 694, 695
  - separation of, from San Diego County 637
  - mine 102, 161
- Rivers in Tuolumne County 132
- Roads in Tuolumne County 133
- "Roaring Soda" spring 224
- Roberts Island Brick Co. 608
    - gas well 612
  - quarry 363
  - Victor, chromite deposit 436
- Robinson Gulch mine 840
  - mine (*see* Acme)
- Roblar Mining Co. 363
- Rochester Oil Co. 310, 312
- Rockingham mine 102
- Rock (*see also* under Macadam; Quarries; Stone Industry) 602
- Rock, Doctor, group 381, 386
- Rocky Bar mine (*see* Trinity Gold Dredge)
  - Point hot sulphur springs 250
    - mine 405
- Rodesina mine (*see* Rose Hill)
- Rodgers Peak 531
- Roe mine 912
- Rogers and Olds, discovery of gold by, in Cove district 481
- Roma mine 596
- Roofing slate 604
- Rooney gravel mine 121
- Roosevelt claim 657, 659
  - placer mine 121
- Rosa claim 448
- Rosalina placer mine 405
- Rose Cañon, brick clays in 685, 686
    - gravel in 676
  - Canyon Brick Co. 686
  - Hill mine 102
  - mine 509
  - quarry 307

PAGE

- Rose—Continued.
  - quartz 521
  - Rock mine (*see* Jumper, Calaveras County)
- Rosedale mine (*see* Buckeye Channel)
- Rosella mine 103
- Roseman mine 771
- Rossland claim 657, 659
- Rothrop mine 820
- Rough & Frye mine 840
  - & Ready mine 406
  - Diamond placer mine 121
- Round Valley, coal in 416, 418
- Royal Bohn mine 509, 522
  - Consolidated mines 103
  - group 596
  - mine 704, 706
  - springs 224
- Roy Bert quarry (*see* Bachigalupi)
- Rubellite (*see* Tourmaline)
- Ruby and Pearl mine 797
  - Basin mine 840
  - copper mine 398
  - King mine 178, 180
    - Mineral Paint Co. 180
  - mine 369, 654, 657, 658
- Rush Creek quarry 919
- Russell deposit 275
  - mine 14
- Russian Dump mine (*see* Russian Hill)
  - Hill mine 855
  - River Gravel Co. 363, 364
- Rustler and San Diego mine 509
- Rutherford mine 596
- Ruth Pierce mine 596
- Ruth ranch graphite 451
- Rycroft mine 855

- Sackett Bros. quarry 315, 370
- Sacramento and Eastern railroad 763, 805
  - River 750, 757, 776, 810
- Saint Agnes College gas wells 412
  - Lawrence mine 744
- Salinas copper mine 418
- Salines (*see* Borax)
- Salmina quarry 297
- Salmon gas well 412
  - Mountain 821
  - River District 821
- Salstrom placer mine 406
- Salt in Colusa County 175, 191
  - Imperial County 741
  - Marin County 242, 250
  - San Diego County 713–716
  - Solano County 312
  - Lake-California mine 382, 383
  - making process 714–715
  - springs in Colusa County 186, 191
    - in Yolo County 369
  - Wells Lake 477
- Salton Basin 638
  - clays in 685
  - Colorado River in 723
  - Miocene formations in 640

PAGE

- Salvador mine 103
- Salvation Army's B. & G. I. Home and Farm springs 337
- Sam Hampton mine 918
  - Houston mine 797
- Sampson's Flat 440, 452
- Samuel Soda Springs 281
- San Andreas mine 104
- San Bernardo, mesa formation at 644
- Sand and gravel (*see also* under Stone industry) 736
  - glass 4, 10, 625, 633, 688
  - silica 633
- San Diego & Arizona Railroad 674, 684, 688, 736, 739
- San Diego County 635–722
  - abrasives in 705–706
  - antimony in 670
  - asbestos in 688
  - auriferous gravel in 652
  - bibliography on 743
  - bismuth in 670
  - brick clays in 685
  - building stone in 671–676
  - cement materials in 684
  - clays, pottery (*see also* Brick) 686
  - coal in 713
  - copper in 665–667
    - nickel with 666, 670
  - crushed stone and sand in 676–683
  - feldspar in 686, 687
  - field work in 635
  - gems in 691–705
  - geologic maps of 645
  - geology of 637–645
  - glass sand in 688
  - gold in 646–665
  - granite in 641, 671–673
  - graphite in 713
  - gypsum in 688
  - history of 637
  - iron in 668
  - jasper in 674
  - kaolin in 686, 687
  - lead in 667
  - lime in 684
  - limestone in 673
  - lithia minerals in 706–708
  - manganese in 668
  - marble in 673–674
  - mica in 689
  - mineral paint in 668, 689
    - resources of 646
    - water in 717
  - molybdenum in 668–669
  - montmorillonite in 688
  - nickel in 666, 670
  - onyx in 674
  - orbicular gabbro in 674–675
  - paragonite in 689
  - petroleum in 708–713
  - phosphates in 717
  - physiography of 637
  - pinite in 689
  - pottery clays in (*see* Clays)

PAGE
San Diego County—Continued.
  quartz in 686, 687
  rainfall in 717
  salt in 713–716
  sand in 676, 683
  saponite in 688
  silver in 667
  stone, crushed, in 676
  tin in 669
  topographic maps of 645
  water in (*see also* Mineral water) 717
  zinc in 668
San Diego Gem Company 703
  Granite Company 672
  mine 657, 660, 707
  Stone Company 680, 681
  Tourmaline Mining Company 700, 701, 707
  Tourmaline mine 707
  Vitrified Brick & Clay Products Company 686
San Domingo mine 596
Sands, black, in Del Norte County 375–379
Sandstone 379
  bituminous 425
  in Amador County 53
    Calaveras County 130
    Colusa County 175, 191–195
    Glenn County 201
    Kern County 522
    Napa County 292, 295, 297, 299
    Shasta County 808
    Siskiyou County 871
San Elijo Oil Company 710
San Emigdio Cañon, antimony in 475
    sandstone in 522
  mine 475, 476
San Francisco City Hall, Raymond granite in 561, 562, 563
  Quarries Company 257, 260
  seawall, rock for 252
San Guiseppi mine 161
San Jacinto Range 637
San Joaquin & Eastern railroad 455
  Brick Company 608
  claim 449
San Joaquin County 607–626
  building materials in 607–610
    brick and pottery 607–610
  irrigation canals in 623
  natural gas in 607, 610–621
  manganese in 621–622
  water resources of 607, 623–625
  window glass in 625
San Joaquin Light & Power Corporation 431, 437, 445, 468, 469, 525, 535, 544, 551, 553, 563, 569, 592, 602, 603
  Marble Company 455
  River 429, 535
  River Rock & Gravel Co. (*see* Santa Fe Gravel Co.)
  Rock & Gravel Co. 449, 468, 469
    gold recovered by 469
  Valley 531
  Valley Coal Company 436, 452

PAGE
San José copper group 573
San José del Valle grant, hot springs on 719
San Luis, Jurassic formations at 639
San Mateo Cañon, copper claims in 665, 666
San Pedro mine (*see* Rockingham)
San Pedro-Senpa-Anita group 700
San Rafael Development Company 260
San Vincente Grant, copper ore on 667
  zinc ore on 668
Santana Brothers mine 910
Santa Ana Gold Mines Company 509, 522
  Mining Company 148
  Triassic formations at 639
Santa Cruz Portland Cement Co. 318
Santa Fe Gravel Company 567
  railroad (*see also* Atchison, Topeka & Santa Fe) 432, 474, 507, 525
Santa Maria Molybdenum Mining & Milling Company 669
Santa Rita (*see* Maricoma)
Santa Rosa Bank quarry (*see* Titania)
  Basalt Rock quarry (*see* McDonald)
  Oil & Development Company 458
Santa Ysabel mine 161
Santee Granite quarry 671, 673
Santissimo mine 142
Saponite in San Diego County 688
Sapphirine chalcedony 521
Saratoga placer mine 167
  springs 221
Sargent & Marlette mine 45
Sarvarum group 405
Sather Bank of San Francisco 660
  Campanile, University of California 567
Satisfaction mine 104
Sauerbrey claim 659
Sauer Kraut mine 855
Sausalito Spring Water Company 250
Savannah mine 538, 550
Savoy placer mine 387
Sawyer mine (*see* North Star)
Schaller, W. T. 694
Scharber mine (*see* Gem)
Scheelite (*see* under Tungsten)
Schloner mine 913
Schocken quarry (*see* Natomas)
Schroeder group 596
  placer mine 600
Schuck, Paul, gypsum deposit 452
Schuler mine 863
"Science" references 676
Scorpion mine 104
Scott Bar district 813, 823
  Mountain 874
  River district 812
    Dredging Company 846, 864
    Mining Company 829
  Springs 868
Scottish Chief mine 797
Screen sizing of gravel 467, 469
Scribner ranch spring 369

PAGE
Scripps Biological Station, letter from, re petroleum 709
Sculptural carving in granite 561, 562, 563
Seal Bluff smelter of Copper King mine 437
"Seam diggings" 820, 825
Search group (copper) 269
Seaton mine 45
Section of Enterprise mine 542
  Gambetta mine 543
  Gladstone mine 787
  Headlight mine 894
  Stonewall mine 661
  Sunnyside mine 450
  Texas Flat mine 551
  Uncle Sam mine 801
Sedimentary deposit of magnesite at Bissell 519
Segregation and Summit claims (*see* Kings Quicksilver)
Seiad mine 856
Seigler hot springs 207, 222
Selby Smelting & Lead Company 573
Self-dumping rock barge 248, 249
  -Shooter mine (*see* Ellston)
Sell mine 161
Seminole mine 162
Senate Document No. 78 of 33d Congress 638
Senger mine 913
Sequoia Resort 282
Serpentine, copper associated with 395
  magnesite in 324, 422
  platinum in 375
Serra, Junipero, founding of San Diego Mission by 637
Seventeen Palms springs 720
Shamrock prospect 234
Sharp & Fellows Constructing Co. 467
Shasta Copper Co. 807
Shasta County 777–809
  antimony in 758–763
  asbestos in 750, 752–755
  auriferous gravel in 776
  bibliography on 809
  brick in 750
  chrome in 750, 755
  clay products in 750, 756
  climatic conditions in 751
  coal in 756
  copper in 750, 757–773
    geology of 757–760
  dredging in 774, 777, 783
  early mills in 774
  first quartz location in 804
  geology of 757–760, 775
  gold in 750, 773–804
    districts in 773–776
    dredging 774, 777, 783
    geology of 775
  granite in 804
  gravel, auriferous, in 776
  hydro-electric plants in 752
  infusorial earth in 805
  iron ore in 750, 759, 805–806

PAGE
Shasta County—Continued.
  lead in 750, 758
  limestone in 750, 758, 806
  macadam in 807
  manganese in 807
  marble in 807
  mineral production of 750
    resources of 751
    springs in 808
    water in 750, 808
  mining industries of 751
  pyrites in 750
  sandstone in 808
  silver in 750, 758
  slate in 750
  stone industry in 750
  timber supply of 750, 758
  transportation facilities in 750
  tuff in 808
  water resources of 750, 758
  zinc in 758, 761, 763, 808–809
Shasta district 773
  Dredging Company 798
  King mine 758, 771
  May Blossom mine 772
  Mining Company 830
  Monarch Mining Company 786
  Springs 868
Shaw mine 104
  prospect (manganese) 333
Sheep Ranch mine 104, 105
  costs at 105
Sheffield mine (*see* Uncle Sam Cons.)
Shell Oil Company 432
Shenandoah mine 45, 105
  mine, San Diego County 649
Sheppard, A. P., infusorial earth deposit 452
Sheridan mine 913
Shiner mine 820
Ship, John & Ward claim 549
Shoestring mine 510
Shoo Fly mine (*see* Haskins)
Short Ranch quarries 260
Shotgun mine 106
Shur, Yunker & De Witt 831
Sickler gem group 700
Sidney group 510
Siebe quarry 315
Sienna marble in Imperial County 735
Sierra & San Francisco Power Co. 140, 146, 168
  Buttes Mining Company 802
  Gold Mining Co. 143
  Lime and Cement Works 169
  Nevada Mountains in Madera Co. 532
    in Siskiyou Co. 811
  Power Company 514
  Rica mine 597
Sierran mineral belt 436, 438
Sightman mine (*see* Cecilville)
Silica (*see also* under Sand, glass)
  in San Diego County 687, 688
    Stanislaus County, analysis of 633
  sand, washed 10

PAGE

- Silken mine, 162
- Silverado mine, 270
  - Mountains mine, 480
- Silver (*see also* under Gold), 4, 54, 132, 179, 206, 750, 811, 814, 875–876
  - Bow mine (*see* Ætna)
  - Boy mine, 510
  - in copper ores, 758
  - in Fresno County, 432
    - Kern County, 474
    - Madera County, 534, 537, 558
    - San Diego County, 667
  - Falls mine, 798
  - Grey mine, 897
  - Lead mine, 597
  - -lead ores, 558
- Simas & Rose mine, 860
- Simmons prospect, 291
- Simons Brick Company, 737
- Simpson-Pirnie Granite Company, 671, 673
- Siskiyou and Nightingale mines, 798
  - Coal Manufacturing Company, 817
- Siskiyou County, 810–872
  - bibliography on, 872
  - brick in, 816–817
  - chrome in, 811, 815, 816
  - clays in, 816, 817
  - coal in, 811, 816, 817
  - copper in, 811, 815, 817–820
  - dredging in, 813, 848, 864–865
  - electric power plants in, 816
  - gems in (*see also* Ornamental stones), 815, 816
  - geology of, 811, 820–825
  - gold in, 812, 813, 814–816, 820–865
    - districts, 821–825
    - dredging, 813, 848, 864–865
    - drift mines, 860–864
    - geology of, 820–825
    - ground sluicing, 858–860
    - hydraulic mines, 844–858
    - placer mines, 843–844
    - quartz mines, 825–842
  - granite in, 865
  - gravel channels in, 812, 822, 824, 843
  - iron in, 865
  - lead in, 811, 815
  - limestone in, 815, 865–867
  - macadam in, 815, 867
  - marble in, 866–867
  - mineral production of, 814–816, 843
    - water in, 811, 814–816, 864–865
  - ornamental stones in, 865
  - platinum in, 811, 814, 815, 846, 869
  - pumice in, 815, 816
  - quicksilver in, 866
  - rubble in, 815
  - sandstone in, 815, 870–871
  - silver in, 811, 814–816
  - soapstone in, 871–872
  - stone industry in, 815, 816
  - streams in, 811–814
  - table of placer production of, 843
  - talc in, 871
  - water resources of, 811–814, 816

PAGE

- Siskiyou Dredging Company, 864–865
  - Klondike mine, 856
  - Mineral springs, 869
  - Mines Company, 856
  - Quicksilver Mining Company, 870
  - River Bend mine, 856
  - Syndicate, 830
- Sites Sandstone Company, 192
- Skaggs Springs, 338
  - clay deposit at, 317
- Skelton mine, 840
- Skinner Graphite Company, 322
- Skylark mine (*see* New York)
- Slate, 131, 604, 750
  - Creek mine, 913
  - in Calaveras County, 131
    - Mariposa County, 604
- Slattery & Welch mine, 798
- Slide Creek mine (*see* Beaudry)
- Slide mine, 799
- Slumway mine, 856
- Smelter, copper, first in California, 572
- Smith and Crookes mine, 106
  - Emery & Company, 459, 633, 719
  - mine, 898
  - Peter, clay deposit, 817
  - Ranch spring, 369
- Smoky City Gold Mining & Milling Company, 656, 659
- Smythe mine, 106
- Snell mine, 162
- Snider mine (*see* Carnegie)
- Snowflake mine, 271, 275
- Snow Gulch mine, 918
- "Soap Creek" (*see* Newman spring)
  - Root mine, 106
- Soapstone and talc, 131
  - in Madera County, 559
    - Siskiyou County, 871–872
    - Trinity County, 924
- Socrates mine, 228, 342, 344, 350
  - native quicksilver in, 228, 342, 350
- Soda Bay springs, 223
  - Springs, Imperial County, 741
- Solano County, 300–315
  - aragonite in (*see* onyx marble)
  - basalt in, 314
  - bituminous rock in (*see* Vulcan quarry)
  - brick and clay in, 300–302
  - cement in, 300, 302–307
  - chromite in, 307
  - coal in, 207
  - fuller's earth in, 307–309
  - lime and limestone in, 300, 309
  - marble in (*see* onyx marble)
  - mineral products of, 300
    - water in, 300, 309, 310
  - natural gas in, 300, 310
  - onyx marble in, 311
  - petroleum in, 311
  - pottery in, 300
  - quicksilver in, 300, 311, 312
  - salt in, 300, 312
  - sandstone in, 315

PAGE
Solano County—Continued.
    stone industry in 300, 313–315
    tuff in 315
Solar evaporation of salt water 713–716
Soledad Pipe Line Company 505
Solfataric action at Sulphur Bank mine 232
    at The Geysers 340, 339
Sonnet mine 162
Sonoma City rock crusher 364
    Consolidated group 350
Sonoma County 316–366
    abrasives in (*see* garnets)
    brick and clay in 316–318
    cement blocks in 318
    chrome in 319
    coal in 319
    copper in 319, 320
    diatomaceous earth in (*see* infusorial)
    garnets in (*see* gems)
    gems in 320, 321
    gold in 321
    "granite" in 321, 352, 357
    graphite in 316, 321, 322
    infusorial earth in 322
    iron in 322
    kaolin in (*see* clay)
    limestone in 316, 323
    magnesite in 316, 324, 333
    manganese in 333
    marble in (*see* Healdsburg Marble Company)
    metacinnabarite in 346, 347
    mineral paint in 316, 333, 334
        products of 316
        water in 316, 334–341
    natural gas in 341
    native quicksilver in 342, 344, 346, 347, 349, 350
    onyx marble in (*see* Healdsburg Marble Company)
    opals in (*see* gems)
    paving blocks in (*see also* under Stone Industry) 316, 351, 352
    petroleum in 341, 342
    quicksilver in 316, 342–351
    stone industry in 316, 351–366
    sulphur in 366
    travertine in (*see* Healdsburg Marble Company)
    "verde antique" marble in 325
Sonoma Magnesite Company 319, 327–332, 341
    mine 106
    mine, quicksilver (*see also* Sonoma Cons.) 342
    Stone & Construction Company 318
Sonora marble quarry 172
Sotoyome Magnesite and Mineral Paint Co. (*see* Healdsburg Paint Co.)
    Magnesite Co. (*see* Norton Ranch)
Soulsby mines 162

PAGE
South Africa mine 106
    Bank mine 106
    Carolina mine 107
        tellurides in 107
    End claim 663
    Eureka mine 4, 45–47
        Mining & Milling Co. 39, 47
    Fork district (*see* Igo)
        mine (*see also* Silver Falls) 913
    High Peak group 656, 659
    Hubbard mine 656, 657
    Jackson mine 47, 48
    San Joaquin irrigation district 623
    Spring Hill mine 4, 48
Southern California Edison Company 475
        Marble Company 520
    Cross group 510
    Pacific Railroad Company 432, 525, 724, 725, 742, 750, 810, 816
        clay deposit of 756
        gravel pits of 200, 297
        limestone deposits of 920
        ochre deposit of 921
        rock quarry for ballast 315
        sandstone quarries of 871
Southwest Turquoise Company 439
Sowden mine 913
Spanish Peak, garnets and tourmaline on 439
Specimen mine 840
Spencer mine 597, 824
Spessartite (*see* Garnet)
Spiers spring 223
Spinel in San Diego County 692
Spodumene (kunzite) in San Diego County 692, 693–694, 706
Spread Eagle mine 597, 772
Spring Day mine 107
Springfield placer mine 168
    Tunnel and Development Company 134
Spring Gulch mine 107
    Hill farm resort 225
    mine 663
    Valley rock quarry 641, 642, 676–679
Springs in Imperial County 741–742
    mineral (*see* under Mineral water)
Square Head placer mine 122
Squaw and Big Chief claims 351
    Creek district 776
        mine 320
    Gulch mine 857
    Mining Company 831
Squirrel mine (*see* Bunker Hill)
Stacy quarry (*see* Lawndale)
St. Francis Hotel (San Francisco), Colusa sandstone in 193
St. George mine 48
St. Helena Bottling & Cold Storage Company (*see* Samuel springs)
    High School 295
    White Sulphur Springs (*see* Original)
St. Juneau mine 48

PAGE

St. Johns quicksilver mine 300, 311, 312
  experiments on oil flotation at 312
Standard Amalgamated Exploration Corporation 77
  and Early Bird mine 108
  Electric Company 80
  mine 550
  Oil Company 432, 525
  Portland Cement Corporation 262
  Quicksilver Company 233
Stanford mine 510
  Mining & Milling Company 485
Stanislaus County 627–634
  building materials in 627–629
    red brick 627
    gravel 627, 629
  clay in 627, 629
  dredging (*see* gold)
  gold in 628, 629
  irrigation canals in 627
  magnesia in 629–630
  manganese in 630
  ochre in 630, 632
  quicksilver in 632–633
  silica in 633
  water resources of 634
Stanislaus Electric Power Company 133
  gravel mine 168
  mine (*see* Melones)
  quicksilver mine 632
  River 132, 623
    gravel on 627, 629
Stanley claim 657, 659
Star and Excelsior mine 62
  mine 163, 558, 841
  of the East mine 898
  of the West mine 107
Starbuck mine 550
Stark, J. M. 747
Starlight group (*see also* Moonlight) 550
  mine 107
Starr King mine 163
State Home, warm springs at 338
State Mining Bureau publications references 523, 532, 533, 556, 572, 605, 606, 622, 629, 633, 639, 640, 642, 643, 645, 647, 648, 649, 653, 654, 662, 676, 691, 692, 720, 724, 729, 743, 809, 872, 925
Stauffer Chemical Company 773
Steele quarry 867
Steffini-Bartini quarry (*see* Hotaling)
Steger mine 108
Steiger Terra Cotta & Pottery Works 11
Steiner's Flat mine 914
Stella district 775
Sterling mine 841
Stevenson mine 772
Stewart mine 694, 696, 697, 704, 707, 708
Stewart's Fork district 883
Stibnite in San Diego County 670
Stock & Stevens asbestos quarries 752–755
Stockton Creek mine 598
  Fire & Enamel Brick Company 608–610
  Hill mine 122

PAGE

Stockton—Continued.
  J. W., gem deposit 521
  Natural Gas Company 613, 614
  natural gas in 614–621
  Ridge Consolidated Mining Company 119
  State Hospital gas wells 613
  Water District 623–625
  Window Glass Company 618, 625
Stone cutters' wages 465, 563
Stone, E. B. & A. L., Company 312, 362, 602
Stone industry, definition of (*see also* under Macadam, Rock, Quarries, Sandstone, etc.) 465
  in Colusa County 175, 195
    Fresno County 465–470
    Glenn County 97, 199–201
    Kern County 519
    Lake County 240
    Madera County 537, 559–567
    Marin County 242, 250–261
    Mariposa County 602–603
    Napa County 262, 292–299
    Shasta County 750
    Siskiyou County 815, 816
    Solano County 300, 313–315
    Sonoma County 316, 351–366
    Trinity County 876
    Yolo County 368, 370
Stonewall Jackson mine 108
Stonewall mine 108, 162, 647, 660–662
  mine, San Diego County, section of 661
Stony Creek gravel pit 200
  Point quarry 364, 365
Stope map of Gladstone mine 787
  Uncle Sam mine 801
Storms, W. H. 532, 653
Stowell mine 772
Stratton, W. N., gas well 528
Straub patent mill 442
Streams of Siskiyou County 811–812
Street Extension mine 142
Street mine 163
Stribbling mine 917
Stringer district 485
  tungsten in 522
Structural geology of San Diego County 641–643
Stuart & Morris mine 163
Stud Horse Flat group 598
Stuparich copper claims 206
Sturdivant mine 914
Sturn mine 857
Suction dredges for gold 777
Sugar Hill mine 863
  Loaf mine 772
Sugerman Nigger mines 163
"Suisun marble" 311
Sullivan mine (*see* John L.)
Sulphide mine 773
Sulphur, at hot springs 747
Sulphur Bank mine 202, 234–238
  borax near 204

PAGE
Sulphur Bank Mine—Continued.
  mineral water in---------- 223, 237
  sulphur in ---------- 196, 234
  thermal waters of---------- 210, 237
"Sulphur Baths" ---------- 458–459
  analysis of water from---------- 459
Sulphur Creek, Colusa County, aragonite on ---------- 188
  gold on ---------- 179
  quicksilver district ---------- 228
  quicksilver mines on---------- 189, 190
  Sonoma County, springs on---------- 341
  thermal waters of---------- 210
Sulphur in Colusa County---------- 196
  in Imperial County---------- 741
    Kern County ---------- 522
    Lake County ---------- 202, 203, 240
    Sonoma County ---------- 340, 366
  Meadows spring ---------- 459
  spring (*see also* under Mineral water) ---------- 225
  Springs mine ---------- 860
Sultana mine ---------- 108
Summit and Montezuma mines---------- 799
  group ---------- 511, 773
  Lime Company ---------- 518
  mine (*see also* Sunny Hill)---------- 108, 291
  quarry ---------- 479, 578
  quicksilver mine (*see* Phœnix)
Sumner mine ---------- 482
  and North Extension mine---------- 511
Sunday Gulch mine---------- 799
Sundown mine ---------- 841
Sunny Hill mine---------- 799
Sunnyside Brick & Tile Company---------- 686
  group ---------- 449–451
    sketch map and section of---------- 450
  mine ---------- 48
Sunrise gem claim---------- 702
  mine ---------- 108, 109, 512
Sunset Brick Company---------- 538
  mine ---------- 511
  oil district, natural asphalt in---------- 476
  springs ---------- 742
Sunshine asbestos claims---------- 476
  group ---------- 598
  mine (*see also* Balfron)---------- 512, 522
Superior copper mine---------- 383
Supplanter mine ---------- 898
Surprise mine ---------- 667, 692, 693, 702
Sutter Creek mine---------- 48
Swallow sulphur claim---------- 741
Swank quarry (*see* Titania)
Swansea, Wales, shipments of copper ore to ---------- 538
Swastika claim ---------- 648
Sweet Home copper mine---------- 397
Sweetwater Dam, rock quarry at---------- 641, 676, 680
  mine ---------- 598
Swiss mine ---------- 109
Sybel mine (*see* Accident)
Sycamore Creek, graphite on---------- 451
  district ---------- 459
Sykes Mining Company---------- 902

PAGE
Sylvan Gravel Company---------- 681
Sylvester Ramus mine---------- 860

Table of geologic formations in southern California ---------- 639
  mineral production of Amador County ---------- 4
    Calaveras County ---------- 54
    Colusa County ---------- 176
    Fresno County ---------- 432
    Glenn County ---------- 197
    Kern County ---------- 474
    Kings County ---------- 526
    Lake County ---------- 203
    Madera County ---------- 537
    Marin County ---------- 242
    Napa County ---------- 262
    Shasta County ---------- 750
    Siskiyou County ---------- 814–816, 843
    Solano County ---------- 300
    Sonoma County ---------- 316
    Trinity County ---------- 875–876
    Tuolumne County ---------- 133
    Yolo County ---------- 368
  paving blocks production in Sonoma County ---------- 352
  placer gold yield in Siskiyou County ---------- 843
Table Mountain in Tuolumne County ---------- 132, 134
  Mountain placer mine ---------- 122
  Rock gravel mine---------- 122
Taft mine ---------- 841
Talc (*see also* under Soapstone)---------- 871
  in Amador County---------- 53
    Calaveras County ---------- 131
Tamalpais mineral water spring---------- 250
Tanglefoot mine ---------- 799
Tanner mine ---------- 109
Tanzy mine ---------- 164
Tarantula mine ---------- 164
Taylor & Maplesden mine (*see* Deep Channel)
Taylor ranch (coal)---------- 319
  white sulphur spring (*see* Kawana)
Teagle-Churchill Potash Company---------- 477
Tebbe mine ---------- 820
Teddy-Avalon mine ---------- 841
Tehachapi district ---------- 485
  limestone in ---------- 516
  Pass ---------- 471
  Valley ---------- 472
Tehipite Dome, copper claims at---------- 438
Tejon Pass ---------- 471
Telluride mine ---------- 663, 664
Tellurides---------- 93, 107, 152, 157, 163, 888
Tellurium mine ---------- 49
Temperance claim ---------- 451
  Flat ---------- 440
Ten Cent Gulch mine---------- 914
Tener mine ---------- 914
Ten Eyck mine---------- 857
Tennant, L. D., gas well---------- 528
Ten Strike mine---------- 552
Terrill, Wm., tungsten deposit---------- 470

PAGE

Tertiary auriferous gravel in San Diego County 652
  clays in Imperial County 737
  deposits in Imperial County 723, 737
    San Diego County 637, 638, 639, 685, 710
Tesla coal mine, clay from 607
Texas Bar mine 914
  Consolidated mine 800
  Flat mine 539, 551
    section of 551
  placer mine 122
  Spring quarry 808
Thayer mine 14
The "400" mine 109
The Garden placer mine 600
The Geysers 212, 364, 338–341
  sulphur at 340, 366
The Jones mine 88
The Minarets 436, 531, 532, 555, 568
  copper at 538
  iron ore at 555–558
  zinc at 568
Thomain mine 857
Thomas ranch, coal on 415, 416
  manganese on 421
Thomasson quarry 313, 314
  test of road material from 314
Thompson Bar mine 406
  Creek quarry 868
Thorp mine 109
Three Brothers claim 659
  Sisters mine 800
  Springs 459
Thrower mine 552
Tia Juana Valley Oil Company 709
Tiburon Point quarry (see N. W. P. Railroad Company)
Tierakoff mine 49
Tile (*see* under Brick, *also* Clays)
Timber supply of Shasta County 750, 758
  Trinity County 874
Tin in Fresno County 470
  San Diego County 669
Tip Top mine 512
Tiscornia, G., Company 78
Titania quarry 365
Toland mine (*see* Al Toland)
"Tolenas onyx" 310, 311
Tolenas Springs 309
  onyx marble at 310, 311
Tolly Hill mine 914
Tom Green mine 800
  Moore mine 475, 476
  Rogers mine 860
  Scott mine 657, 659
  Smith mine 110
Tonzi ranch, talc on 53
Topaz 438, 692
Top Notch mine 915
Topographical features of Siskiyou County 811
    Trinity County 873
  maps of Imperial and San Diego counties 645

PAGE

Topps mine (*see* Pure Gold Mining Company)
Top-slicing stoping method 767
Toughnut mine 898
Tourmaline in Fresno County 439
    San Diego County 691–693, 696–703
  King mine 697, 708
  "Nile green" 703
  Queen mine 697, 708
  Queen Mountain 696, 698, 707
  use of by Chinese 691
Tower ranch chromite 56
  slate on 131
Townsite claim 657, 660
Trail Creek mine 841
Transportation facilities 3, 54, 133, 432, 474, 525, 554, 750, 810, 874
Trask, Dr. John B. 638
Travertine (*see also* Onyx marble) 303
Treadwell mine (*see* Sutter Creek)
Treasure Gold Mining Company 591
  mine 3, 49, 50
Treasury claim 663
Trenchard, W. H. 636
Trestle mine 512
Trewhitt brick yard 527
Triangle mine 898
Triassic formations at Santa Ana 639
  rocks in Shasta County 758
Trimmer springs 459
Trinity Asbestos Mining Company 877
  Bonanza King mine 898–899
  Center district 873, 874, 883
  Consolidated hydraulic mine 915
  Consolidated mine 802
  Copper Company 771
Trinity County 873–925
  asbestos in 876–877
  Bank 897
  bibliography on 925
  chromite in 877
  coal in 877–878
  copper in 875–876, 878–882
  dredging in 874, 883
  electrical power plants in 876
  gems in (*see* Ornamental stones)
  geology of 874, 882
  gold in 874, 875, 876, 882–919
    dredging 874, 875, 918–919
    drift mines 917–918
    geology of 882
    ground sluicing mines 916–917
    hydraulic mines 905–916
    mining districts 882–883
    placer mines 905–919
    quartz mines 844–901
  granite in 919–920
  history of 874
  iron in 920
  limestone in 920
  marble in 921
  mineral paint in 921
    production of 875–876
    resources of 875
    water in 921–922

PAGE
Trinity County—Continued.
  mining conditions in 874
    districts in 882–883
  ornamental stones in 922
  platinum in 875–876, 902, 903, 905, 907, 909, 911, 913, 915, 917, 922, 923
  power plants in 876
  quicksilver in 875–876, 923–924
  silver in 875–876
  soapstone in 924
  stone industry in 876
  table of mineral production of 875–876
  tellurides in 888
  timber resources of 874
  topography of 873
  water resources of 874
Trinity Dredging Company 864
  Exploration Company 917
  Gold Dredge Company 876, 919
    Mining & Reduction Company 876, 892
    Mining Company 909, 914
  Hydraulic Gold Mining Company 911
  quicksilver mine 924
  River 175, 873, 874
    Hydraulic Gold Mine 907
    Mining Company 915
Trio mine (*see also* Harvard) 164
Tropico mine 512
Trout Creek prospect 179
True Blue mine 900
  Fissure mine 900
Truscott mine 802
Tryon mine 110
Tucker, W. B. 1
  quarry 315
Tuff (*see also* under Stone Industry) 808
Tulare Lake 471, 525
  Lake View group 527
Tullock mine 110
Tungsten in Fresno County 470
  Kern County 522
    gold associated with 504, 507, 513, 522
  Madera County 568
  San Diego County 670
Tuolumne County 132–172
  Big Oak Flat district in 136
  brick in 132
  chrome iron in 132, 134
  copper in 132, 134, 135
  East Belt in 135, 136
  electric power 132, 133
  geology of 135, 136
  gold in 132, 135–168
    placer mines in 166–168
    quartz mines in 136–166
  granite in 132
  Groveland district in 136
  lead in 132
  limestone and lime in 132, 168–169
  marble in 132, 169–172
  mineral products of 132, 133

PAGE
Tuolumne County—Continued.
  mining conditions in 133
  Mother Lode in 133, 135
  railroad facilities in 133
  roads in 133
  silver in 132
  Table Mountain in 132, 134
  tellurides in 152, 157, 163
  transportation to 133
Tuolumne River 132
    dredging on 629
  Water Power Company 132, 133
Turner Oil Company 461
Turquoise in Imperial County 740
  Madera County 539
Tuscan tuff 808
Twan and Hannan mine 841
Twin Peaks mine 291
Two and a Half mine 857
  to One mine 510
Tychson quarry 298
Tyro mine 598, 599
Tyson Mining Company 180

Uncle Sam Consolidated mine 822, 842
  group 438
  mine (*see also* Lucitta) 776, 801, 802
    plan of workings of 801
    stope map of 801
  mine (Trinity County) 900
Union and Burgess group 110
  Brick Company 686
  Consolidated mine (*see* Clinton Cons.)
  Construction Company (*see* Petaluma Rock)
  Copper Company 182
  copper mine 62, 63
    cost at 63
  Development Company 71, 91
  Hill mine 915
  Lime Company (*see* Summit)
  oil well 411
  Shaft mine 122
  Water Company 111
United Gold Mining & Milling Co. 164
  Mines Company 726
    group 164–165
United States Department of Agriculture, bulletin on mineral waters 208
    test of road material by 314
  Geological Survey, investigations of radioactivity by 210
    maps by 645
    publications, references 523, 622, 630, 640, 642, 647, 653, 665, 717, 720, 724, 741, 750, 809, 872, 925
  Mining & Smelting Company 767
  Mint reports 535
  National Museum, San Diego gems specimens in 692
  Sub Treasury Building, granite columns in 566
  Weather Bureau reference 717

PAGE

- University of California, buildings at,
  - of Raymond granite 560, 566, 567
    - geological publications, references 644, 645, 676, 809
- University Peak 430
- Upper Soda Springs 868
- Upton mine (*see* Corona de Oro)
- Ural mine (*see* Chicago)
- Urbana & Frank mine 512–513
- U. S. Grant mine 164
- Utah & California mine 803
- Utica group 54, 110
  - mine 65, 66, 110–112
- Utopia mine 239

- Vacaville fuller's earth 307
- Valdor mine 916
- Vallecito Gold Mining Company 123
  - springs 721
- Vallejo and Napa Gas & Oil Co. 311
  - Brick & Tile Company 300
  - Estate quarries 365
  - Quicksilver Mining Company 286
  - Sulphur springs 310
  - White Sulphur springs 310
- Valley Center, silver-lead ore at 667
    - zinc in 668
  - quicksilver mine 276
  - Springs Mineral Water Company 130
  - View district 485
- Valparaiso mine 52
- Valverde mine (*see* Phoenix Development Co.)
- Van Allen mine 420
  - Wert claim 653, 657
- Vassar magnesite claims 422
- Vatinell & Company mine 843
- Veatch, Dr. John A. 204
- Venicia mine 900
- Venturina Mining & Milling Co. 656, 660
- "Verde antique" marble 325
- Vesuvianite (*see also* Californite) 869
  - in San Diego Company 704
- "V" flumes, transportation of lumber by 431, 535, 536
- Vichy springs 422, 423
  - analytical comparison of 423
- Victor Bonanza group 605
  - mine 803
  - Mining Company 799
  - Power and Mining Company 792, 803
- Vine Oak mine 165
  - Spring mine 165
- Viola placer mine 123
- Violetti quarry 366
- Virginia mine (*see also* Bulwer) 599
- Vista Chief claim 702
- Vogdes, A. W. 636
- Vogelsang ranch chromite 55
- Voinich mine 112
- Volcanic ash 299
  - in Fresno County 470
    - Madera County 568
- Volcano No. 1 mine 552
- Voluntine mine (*see* Chapman)

PAGE

- Voyle ochre mine 630, 632
- Vulcan mine 766
  - Rock Company 315
    - rock of, not "bituminous" 315
- Vulture claim (*see* Graveyard)

- Wages of stone cutters 465, 563
- Wagner Mining Company 897
- Wahtoke, fuller's earth at 439
- Wakefield, Wm.. placer 451
- Walker clay deposit 817
  - mine (*see* Utah; *also* Two and a Half)
  - -Mundy claims 439
  - prospect 351
- Wall prospect (copper) 320
  - spring 341
  - spring prospect (quicksilver) 351
  - Street mine 226, 232, 239
    - concentration at 240
- Walters magnesite (*see* Pope Valley)
  - springs 282
- Ward & Trinity mine (*see* La Grange)
  - L. F., magnesite deposit 455
  - tract deposit (copper) 320
- War Eagle claim 664
- Ware, J. W. & Company 703
- Waring, C. A. 461
- Warlock group 657, 659
- Warmcastle Soda springs 869
- Warner's Hot springs 719
- Warren marble quarry 172
- Warrington mine (*see* Little Angel)
- Washington mine (*see also* Aetna; *also* High Grade) 552, 653, 657, 658, 773, 774, 804
  - mine (copper) 135
    - (gold) 112
  - placer claims 387
- Water consumption of Stockton 625
  - jet condenser for quicksilver retort 289, 291
  - Lily mine 112
  - resources of Fresno County 430
    - Kern County 472
    - Madera County 535
    - Mariposa County 569
    - Merced County 606
    - San Diego County 717–722
    - San Joaquin County 607, 623–625
    - Shasta County 750, 758
    - Stanislaus County 627, 634
- Waterloo and Consolidated Four mines 552
- Waterman mine 112
  - quarry 672, 673
- Watt gravel pit 298
- Weaver Basin 873
- Weeks, F. B. 555, 557
- Weise clay pit 317, 318
  - analysis of kaolin from 318
  - kaolin in 317
  - opals at 321
- Weitchpec Bar mine 407
- Welch and Star mines 63
  - mine 820

PAGE

- Well logs, gas, at Stockton ... 619–621
- Wells (see under Natural Gas; also Water)
  - coal deposit ... 417
- Werringer sulphur springs ... 521
- West Eureka mine ... 52
  - Lake mine ... 123
  - Lode Belt in Calaveras County ... 66
  - Point district ... 64
- Western Carbonic Acid Gas Co. ... 325, 332
  - Development Syndicate (see San Francisco Quarries Company)
  - Exploitation Company ... 793
  - Exploration Company ... 762
  - Fuller's Earth Company ... 307, 308
  - Meat Company, use of fuller's earth by ... 308
  - Pacific Railroad ... 607
  - Salt Company ... 713–716
  - States Gas & Electric Company ... 609, 610, 613–621, 625
  - Zinc Company ... 765
- Wet Gulch placer mine ... 123
- Wetmore Brothers quarry (see Daniel Contracting Company)
- Weyle quarry ... 366
- What Cheer mine ... 123
- Wheal Ruff mine ... 166
- Wheeler, C. Gilbert ... 717
  - gravel pit ... 629
  - mine (see Alpine)
- Wheelock mine ... 112
- Whiskey Flat district ... 481
  - Hill mines (see Harvard)
- Whistle Bar mine ... 864
- White Bear mine ... 842
  - cement ... 318
  - Chief Mountain ... 532
  - Cloud claim ... 697
    - Pocket mine ... 900
  - Cross mine (see M. & M.)
    - limestone near ... 452
  - Gold Basin mines ... 730
  - Gulch Mining Company ... 599
  - Oak claim ... 599, 649
  - Queen mine ... 694, 700
  - Rock group (copper) ... 269
    - magnesite (see Pope Valley)
  - Star mine ... 513
  - sulphur springs (see Original; also Vallejo)
- Whitlock group ... 599
- Whitmore mine (see Ama Oro)
- Whitney, J. D. ... 602
  - prospect ... 292
- Whittel mine ... 113
- Whittle mine ... 14
- Wicks mine ... 842
- Wide Awake mine (see also Providence) ... 113, 190
  - limestone at ... 179
- Wilcox claim ... 659
- Wilbur Hot Sulphur springs ... 184, 186
  - ammonia in ... 187
  - borax in ... 187
- Wilbur Womble mine ... 113

PAGE

- Wild Cat claim ... 649
  - Goose oil wells ... 412
- Wildermuth quarry ... 130
- Wildman and Mahoney mine ... 4, 36, 52
- Wilker mine ... 918
- Wilkinson quarry (see McNeill)
- Willard mine ... 857
  - Mining Company ... 100
- William Morris mine ... 916
- Williams Oil Company ... 188
  - quarry ... 298
- Willieta mine ... 166
- Williamson, Lieut. R. S., expedition under ... 638
- Willow Creek, gold on ... 400
    - mine ... 553
  - mine ... 513
  - springs ... 521
- Willows City gravel pit ... 201
- Wilson & Means pocket mine ... 142
- Wilson mine (see also Mud Springs) ... 864
- Windeler mine ... 858
- Windy Gold Mining Co. ... 513
- Wingate Hill mine (see Quartz Hill)
- Wing-dams, mining by ... 810
- Wing quarry ... 298
- Winnie mine ... 513
  - tungsten in ... 513, 522
- Winship manganese deposit ... 622
- Wise mine ... 166
- Witter springs ... 203, 207, 223
- Wm. Burns mine ... 858
- Wolframite (see under Tungsten)
- Wolverine mine ... 114
- Wood & Fehely ... 858
- Woodbridge Canal & Irrigation Co. ... 623
- Woodbury mine ... 916
- Woodhouse mine ... 114
- Woodland mine ... 553
- Woods & Harlan prospect ... 181
- Woody district ... 479, 485, 516
- Workman, E., gas well ... 528
- Worswick Street Paving Co. (see California R. & S. Improvement Co.)
- Wright and Fletcher mine ... 823
- Wright ranch chromite ... 56
- Wymore quarry (see also Melitta) ... 356
- Wyo gravel pit ... 200

- X. L. C. R. Mining Company ... 287

- Yager Creek springs ... 410
- Yankee Dam mine ... 843
- Yellow Aster ... 481, 483, 485, 514
  - Astor mine ... 900
  - Butte mine ... 820
- Yellowstone Park, Wyoming ... 210, 339
- Yolo County ... 367–370
  - brick in ... 367
  - coal in ... 367
  - gold in ... 367
  - limestone in ... 368
  - manganese in ... 368
  - mineral products of ... 367, 368
    - water in ... 369
  - quicksilver in ... 368, 369

PAGE

Yolo County—Continued.
  sandstone in 368, 376
  stone industry in 370
Yordi ranch magnesite 333
Yosemite Copper Mines Company 539, 554
  Gold Dredging & Mining Co. 606
  Rock quarry 602–603
  Stone quarry 603
  Valley 569
  Valley railroad 576, 602, 603
You Bet group 662
Young, Doctor, hydraulic mine 387
  limestone quarry 128
Yreka Creek district 813
Yuba Oil Company 740
  springs 742
Yuma-Arizona group 729
Yuma Mill & Mining Company 725

PAGE

Zaar, Frank, copper mine 183, 184
Zacatera mine (*see* North Star)
Zeda mine (*see* Gold Peak)
Zarina mine 822, 842
Zebra mine 553
Zeila mine 4, 51, 52
Zenda mine 515
Zem Zem spring 282
Zinc 808–809
  associated with copper ore 12, 58, 59, 761, 765, 809
  in Madera County 568
    San Diego County 668
Zincblende, phosphoretic 602
Zollner quarry 298
Zulu mine 553

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